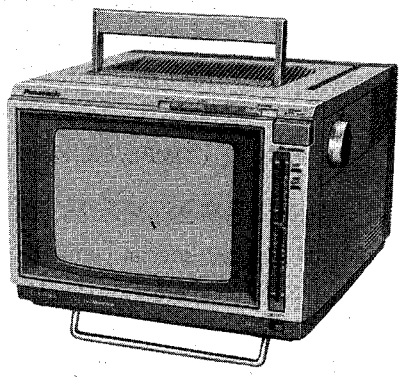
ORDER NO. KME8507048C1
B1

# Service Manual

Color Television Monitor

# CTG-713

## Chassis NMX-K82D



The service technician is required to read and follow the "Safety Precautions" and "Important Safety Notice" in this service manual.

### Specifications

| | |
|---|---|
| Power Input: | 120 volt, 60 Hz, AC<br>12 volt and 24 volt DC |
| Power Consumption: | AC – 36 watts average,<br>0.6 Ampere max.<br>DC – 27 watts average<br>2.7 Ampere max. |
| Antenna Impedance: | UHF 300 ohm Balanced<br>VHF 75 ohm Coaxial<br>(300Ω ~ 75Ω adapter is enclosed.) |
| Receiving Channels | |
| Regular TV: | 2 – 13 (VHF)<br>14 – 69 (UHF) |
| CATV: | 2 – 13, 5A (VHF)<br>A-2, A-1, A – I (MID BAND)<br>J – W (SUPER BAND) |
| Intermediate Frequency: | Video IF carrier 45.75 MHz<br>Sound IF carrier 41.25 MHz<br>Color sub-carrier 42.17 MHz |
| Semiconductors: | 31 transistors<br>77 diodes |
| Integrated Circuits: | 8 |
| Anode Voltage: | 16.5 kV ± 1.0 kV<br>(Zero Beam Current) |
| Sound Output: | 0.7 watt (10% Distortion) |
| Speaker: | 3 inch Round<br>Dynamic Voice Coil 16 ohm |
| ColorPilot: | One button adjustment for Color, Tint, Brightness and Contrast. |
| Automatic Circuits: | Automatic Fine Tuning<br>Peak Value AGC<br>Automatic Voltage Regulator<br>Automatic Beam Limiter<br>Automatic Frequency and Phase Control<br>Automatic Horizontal Frequency Control<br>Automatic Noise Canceller<br>Automatic Color Control |
| Picture Tube: | A18JHC30X 23 square inches<br>7 inches measured diagonally.<br>70° deflection<br>Quintrix II In-Line |
| Dimensions: | Height: 7-3/8 inches (186.0 mm)<br>Width: 9-3/4 inches (247.5 mm)<br>Depth: 12-1/8 inches (308.5 mm) |
| Weight: | 12-1/2 lbs. (5.8 kg) |

Weight and dimensions shown are approximate.

Specifications are subject to change without notice.

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*THIS MODEL COMPLIES WITH DHHS RULES 21 CFR SUBCHAPTER J APPLICABLE AT DATE OF MANUFACTURE.*

**IMPORTANT SAFETY NOTICE**

There are special components used in Panasonic TV sets which are important for safety. These parts are shaded on the schematic diagram and on the replacement parts list. It is essential that these critical parts should be replaced with manufacturer's specified parts to prevent X-RADIATION, shock, fire, or other hazards. Do not modify the original design without permission of Matsushita Electric.

## ABBREVIATIONS USED IN THIS MANUAL

| | |
|---|---|
| **ABL** | Automatic Beam Limiter |
| **ACC** | Automatic Color Control |
| **AGC** | Automatic Gain Control |
| **AFT** | Automatic Fine Tuning |
| **APF** | Active Power Filter |
| **APC** | Automatic Phase Control |
| **AVR** | Automatic Voltage Regulator |
| **CRT** | Cathode Ray Tube |
| **DY** | Deflection Yoke |
| **FBT** | Flyback Transformer |
| **OTL** | Output Transformerless |
| **SEPP** | Single-Ended Push-Pull Circuit |
| **HAFC** | Horizontal Automatic Frequency Control |
| **ADDP** | Automatic Deep Discharge Protection |

# SAFETY PRECAUTIONS

## GENERAL GUIDELINES

1. It is advisable to insert an isolation transformer in the power line and AC supply before servicing a hot chassis.
2. When servicing, observe the original lead dress, especially the lead dress in the high voltage circuits. If a short circuit is found, replace all parts which have been overheated or damaged by the short circuit.
3. After servicing, see to it that all the protective devices such as insulation barriers, insulation papers, shields and isolation R-C combinations are properly installed.
4. Before turning the receiver on, measure the resistance between B+ line and chassis ground. Connect ⊖ side of an ohmmeter to the B+ lines, and ⊕ side to chassis ground. Each line should have more resistance than specified, as listed above.

| B+ Line | Minimum Resistance |
|---|---|
| 114V | 60kΩ |
| 12V | 550Ω |

5. When the TV set is not to be used for a long period of time, unplug the power cord from the AC outlet.
6. Potentials, as high as 18.0 kV are present when this receiver is in operation. Operation of the receiver without the rear cover involves the danger of a shock hazard from the receiver power supply. Servicing should not be attempted by anyone who is not thoroughly familiar with the precautions necessary when working on high voltage equipment. Always discharge the anode of the picture tube to the receiver chassis before handling the tube.
7. After servicing make the following leakage current checks to prevent the customer from being exposed to shock hazards.

## LEAKAGE CURRENT COLD CHECK

1. Unplug the AC cord and connect a jumper between the two prongs on the plug.
2. Turn on the receiver's power switch.
3. Measure the resistance value, with an ohmmeter, between the jumpered AC plug and each exposed metallic cabinet part on the receiver, such as screwheads, antennas, control shafts, handle bracket, etc. When the exposed metallic part has a return path to the chassis, the reading should be between 240kΩ and 5.2MΩ.
   When the exposed metal does not have a return path to the chassis, the reading must be ∞.

## LEAKAGE CURRENT HOT CHECK (See figure 1.)

1. Plug the AC cord directly into the AC outlet. DO NOT use an isolation transformer for this check.
2. Connect a 1.5kΩ, 10 watt resistor, in parallel with a 0.15μF capacitor, between each exposed metallic part on the set and a good earth ground such as a water pipe, as shown in figure 1.
3. Use an AC voltmeter, with 1000 ohms/volt or more sensitivity, to measure the potential across the resistor.
4. Check each exposed metallic part, and measure the voltage at each point.
5. Reverse the AC plug in the AC outlet and repeat each of the above measurements.
6. The potential at any point should not exceed 0.75 volts RMS. A leakage current tester (Simpson Model 229 or equivalent) may be used to make the hot checks. Leakage current must not exceed 1/2 milliamp. In case a measurement is outside of the limits specified, there is a possibility of a shock hazard, and the receiver should be repaired and rechecked before it is returned to the customer.

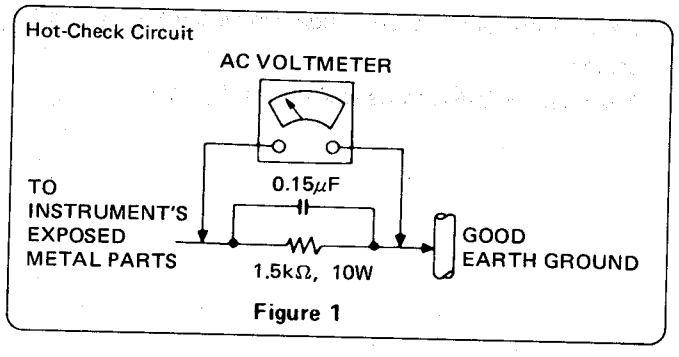


Figure 1

## X-RADIATION

**WARNING:** 1. The potential source of X-Radiation in TV sets are the High Voltage section and the picture tube.
2. When using a picture tube test jig for service, make sure that the jig is capable of handling 18.0 kV without causing X-Radiation.

**Note:** It is important to use an accurate, periodically calibrated high voltage meter.

1. Turn Bright and Panabrite controls fully counterclockwise.
2. Set ColorPilot switch to OFF position and Service switch to SERVICE position.
3. Measure the High Voltage. The high voltage meter (electrostatic type) reading should indicate 16.5 kV ± 1.0 kV. If the meter indication is out of tolerance, immediate service and correction is required to prevent the possibility of premature component failure.
4. To prevent an X-Radiation possibility, it is essential to use the specified picture tube.

## HORIZONTAL OSC. DISABLE CIRCUIT TEST

**SERVICE WARNING:** This test must be made as a final check before set is returned to customer.

1. With rear cover removed, supply nominal 120V AC to set and turn on power switch.
2. Adjust customer controls to normal position.
3. Short pin ① to pin ② of IC801 with a jumper wire. Confirm that the picture tube screen blacks out (horizontal oscillation stops).
4. If the test fails, Horizontal Oscillator Disable Circuit is not operating and must be repaired. Refer to the Horizontal Oscillator Disable Circuit Repair Procedure.

## HORIZONTAL OSC. DISABLE CIRCUIT REPAIR PROCEDURE

1. Connect a DC voltmeter between the cathode of D505 and chassis ground of the main circuit board. If approximately 11.0V is not present on the cathode, find the cause. Check R523, D503 and D505.
2. If approximately 11.0V is present on the cathode, check IC401, R518, C515 and D504.
3. Carefully check above specified parts, and related circuits and parts. When the circuit is repaired, try the horizontal oscillator disable circuit test again.

# DISASSEMBLY INSTRUCTIONS

## UPPER CABINET REMOVAL

1. Remove 6 Ⓐ screws shown in figure 2.
2. Remove upper cabinet by lifting it upwards as shown in figure 2.

## SPEAKER REMOVAL

1. Remove 2 screws which mount the speaker to the upper cabinet.

## REAR CABINET REMOVAL

1. Remove 6 Ⓒ screws shown in figure 2.
2. Pull the rear cabinet backwards.

## SIDE CABINET BOARDS SWING OUT

1. Remove tuning control knob on right side.
2. Pull the side boards out of the escutcheon one by one and both of the side boards will swing out as shown in figure 3.

## MAIN PCB (A-BOARD) SERVICE POSITION

1. Remove 1P lug terminal mounting screw Ⓓ from heat sink. (Figure 3)
2. Remove 4 Ⓔ screws from A-Board. (Figure 3)
3. Release the anode lead from the 2 clamps.
4. Release other leads which are clamped in place and obstruct the A-Board path to the service position.
5. Stand the A-Board at the arrow-marked position on the bottom of the cabinet as shown in figure 4.

## POWER SUPPLY PCB (B-BOARD) SERVICE POSITION

1. Remove 3 Ⓕ screws from heat sink. (Figure 3)
2. Remove 3 Ⓖ screws from B-Board. (Figure 3)
3. Stand the B-Board at the arrow-marked position on the left side of the cabinet as shown in figure 4.

## SIGNAL PCB (N1-BOARD) SERVICE POSITION

1. Remove 4 Ⓗ screws from N1-Board. (Figure 3)
2. Remove 1 Ⓘ screw from antenna terminal bracket. (Figure 3)
3. Release leads which are clamped in place and obstruct the N1-Board path to the service position.
4. Stand the N1-Board with tuner down on the right side of the cabinet as shown in figure 4.

## TUNING BLOCK REMOVAL

1. Remove 3 Ⓙ Red screws which mount the tuning block to the front cabinet. (Figure 5)
2. Slowly pull the tuning block backwards until the power switch knob releases from the front cabinet.

## VOLUME CONTROL REMOVAL

1. Remove 2 Ⓚ Red screws which mount the control to the front cabinet. (Figure 5)
2. Slowly pull the control backwards until the control knob releases from the front cabinet.

## TOP CONTROL PCB (U-BOARD) REMOVAL

1. Pull off 3 nylatches Ⓛ (males and females), which secure the U-Board to the right side of the cabinet shown in figure 6.

## MONITOR PCB (L-BOARD) REMOVAL

1. Remove 1 Ⓘ screw which secures the antenna terminal board to the right side cabinet. (Figure 6)
2. Remove 2 Ⓜ screws which secure the L-Board to the antenna terminal board. (Figure 6)
3. Unsolder Video and Audio input terminals from the L-Board.

## PICTURE TUBE REMOVAL

1. Remove tuning block and audio control from the front cabinet.
2. Disconnect the CRT PCB (C-Board) and the anode lead from the picture tube and the DY coupler from the A-Board.
3. Remove 1 Ⓝ screw as shown in figure 5.
4. Place the set with the picture tube face down and remove 2 screws on bottom of the cabinet.
5. Remove bottom and both side cabinets from the front cabinet.
6. Then remove 3 Ⓟ screws as shown in figure 7.

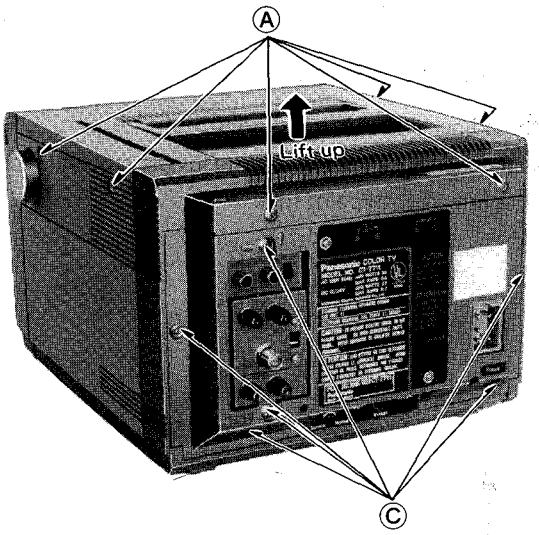



Figure 2

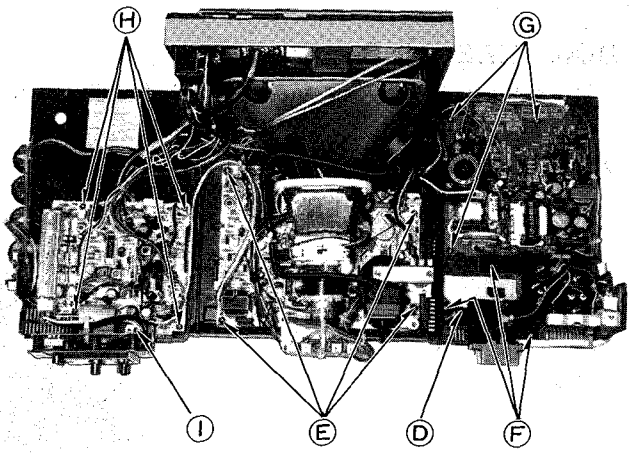



Figure 3

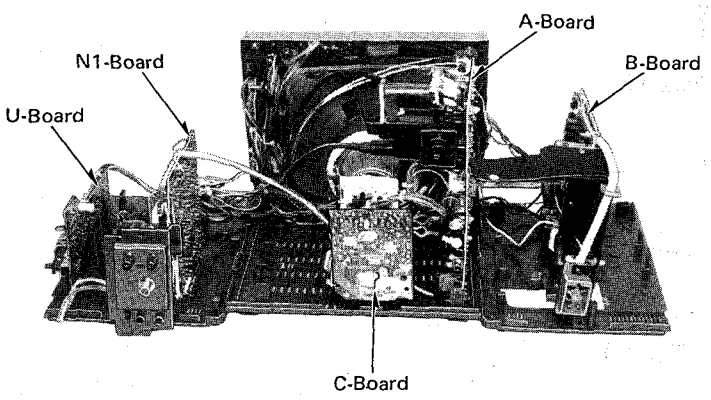



Figure 4

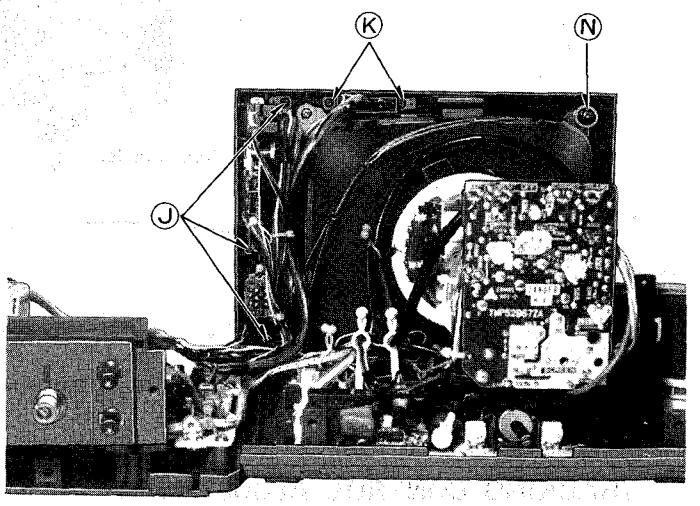



Figure 5

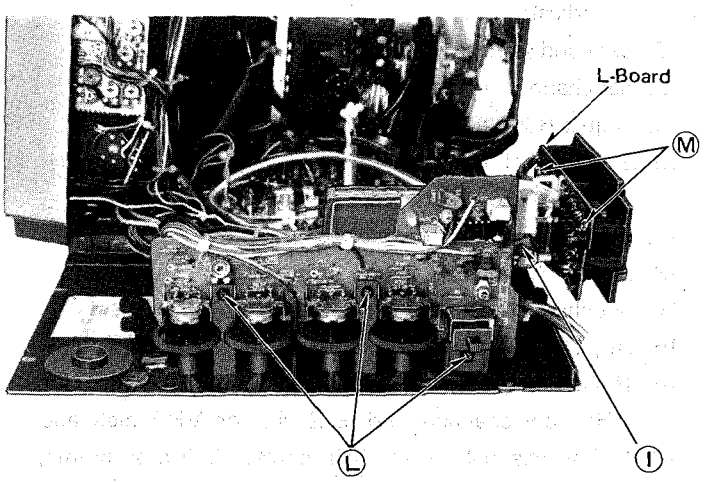



Figure 6

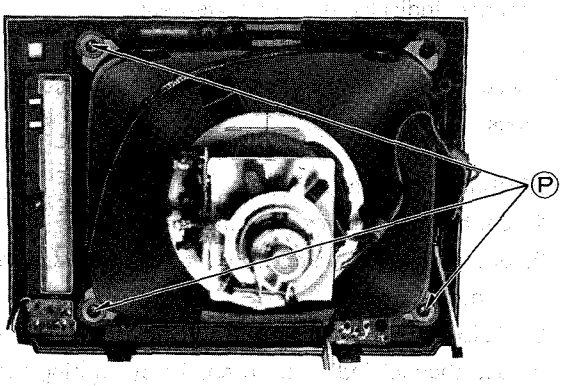



Figure 7

# TUNING CONTROL ADJUSTMENTS

## DIAL THREADING

1. Turn the pulley on the tuning VR shaft fully counter-clockwise.
2. Arrows (①~⑦) indicate correct order and direction of dial threading as shown in figure 8.
3. Slide the channel indicator to the lowest end and secure it to the thread with paint lock.

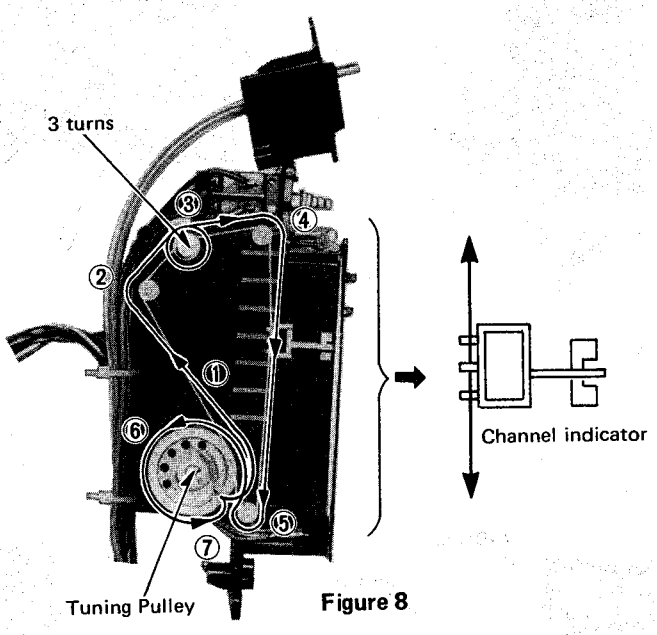



Figure 8

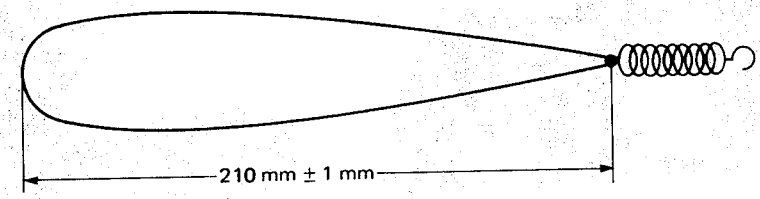



Figure 9

## TRACKING CONTROL ADJUSTMENT

**Alignment**

1. Set AFT switch (SW151) to OFF position.
2. Set tracking adjust controls (R005, R006, R007, R008, R009, R010) to center position.
3. Turn the tuning knob counterclockwise until the channel indicator is at the lowest end.
   Then turn the tuning knob 2 more turns.
4. Secure the channel indicator to the thread with paint lock.

**Adjustment Procedure**

1. Set band select switch to UHF position.
2. Set channel indicator to ch. 69 by turning the tuning knob.
3. Adjust R006 to obtain the best picture at ch. 69.
4. Set channel indicator to ch. 14 by turning the tuning knob.
5. Adjust R010 to obtain the best picture at ch. 14.
6. If the best picture is not obtained within ± 2 ch. from its correct indicator point, repeat step 2 to step 5.

**Note:** If channels 14 and 69 are not available, set the channel indicator at the nearest channel to 14 or 69 available in your area to adjust the channel indicator.

7. Set band select switch to VHF/CATV position.
8. Set channel indicator to ch. W (CATV Super Band).
9. Adjust R005 to obtain the best picture at ch. W.
10. Set channel indicator to ch. A-2 (CATV Mid Band).
11. Adjust R009 to obtain the best picture at ch. A-2.
12. Set channel indicator to ch. 6.
13. Adjust R008 to obtain the best picture at ch. 6.
14. Set channel indicator to ch. 2.
15. Adjust R007 to obtain the best picture at ch. 2.
16. If the best picture is not obtained within ± 0.5 ch. for VHF low channels and ± 2 ch. for VHF high and CATV channels from their correct indicator points, repeat step 8 to step 15.

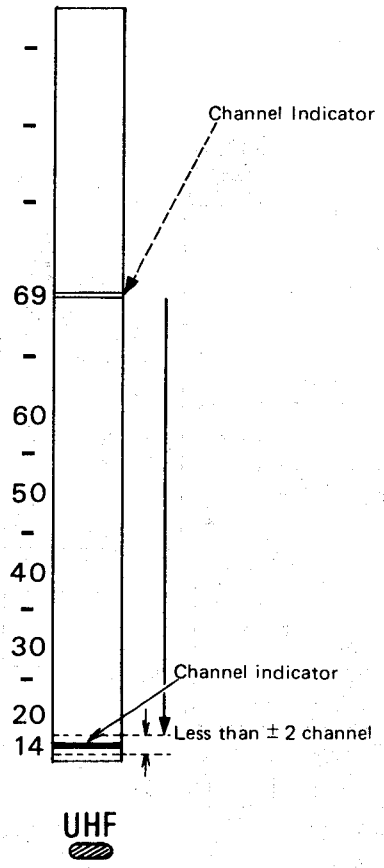



**Figure 10**

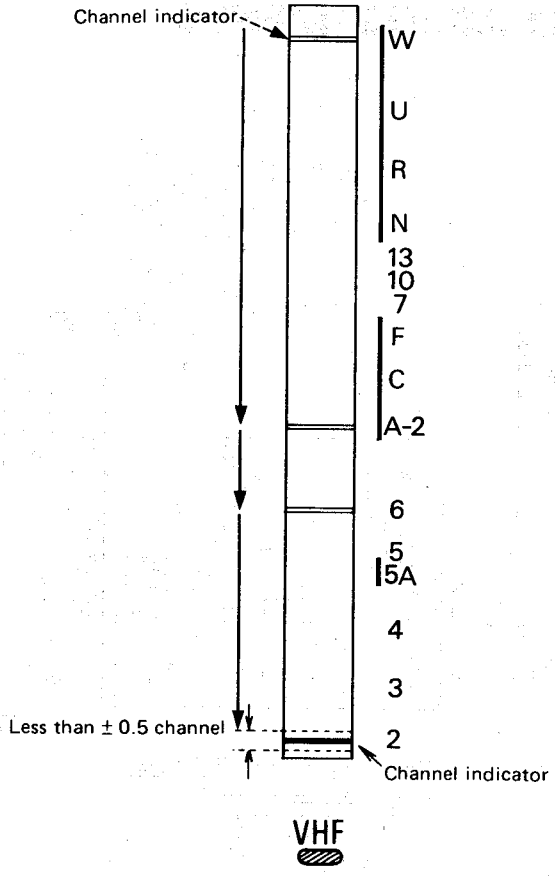



**Figure 11**

**Note:**

1) The following conditions are required.

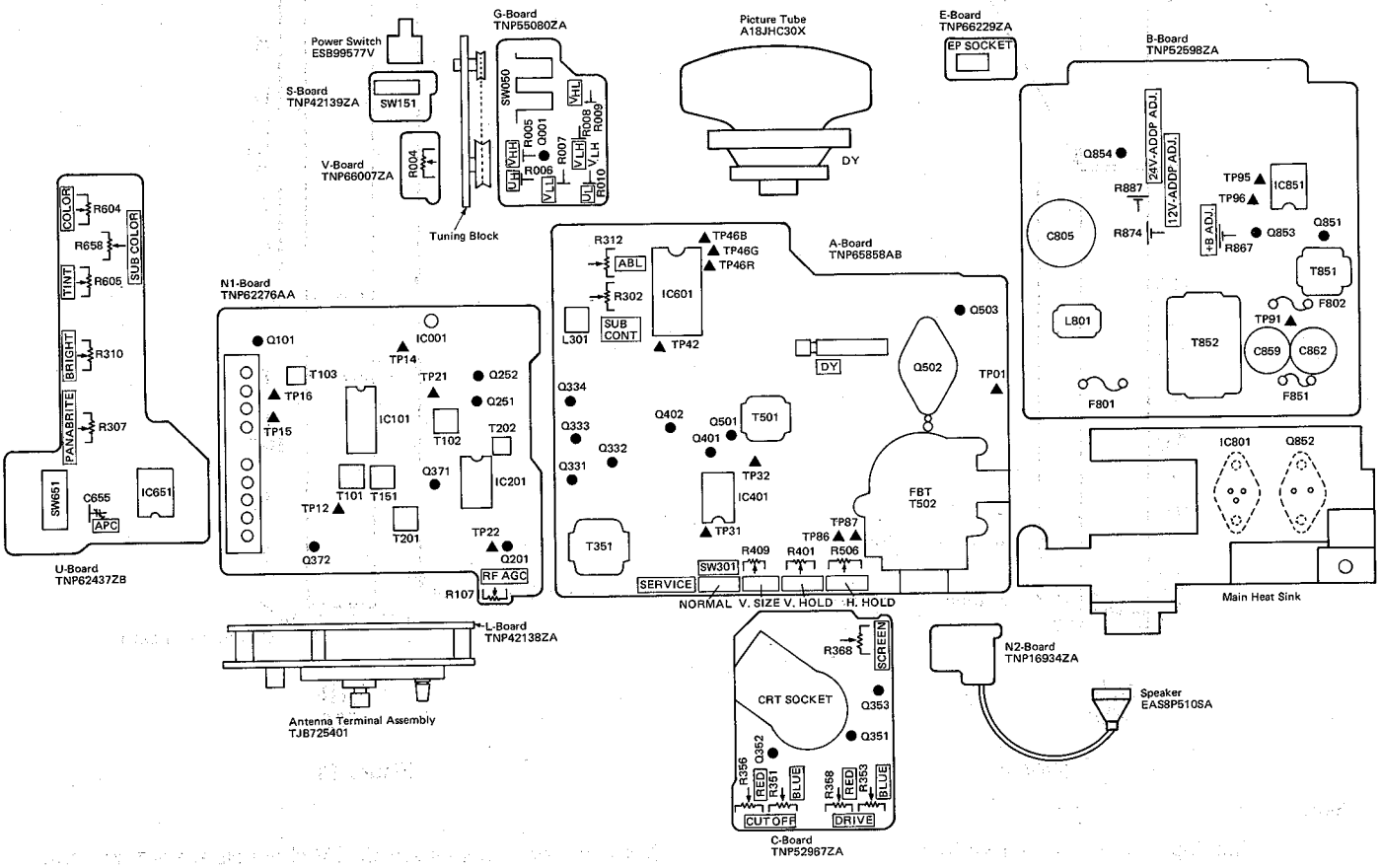
UHF: To obtain the best picture from ch. 14 to ch. 69, deviation of ± 2 ch. from the correct tuning indication is acceptable.

VHF/

CATV: To obtain the best picture from ch. 2 to ch. 6 (VHF low channels) deviation of ± 0.5 ch. from the correct indicator point is acceptable, and from ch. 7 to ch. 13 (VHF high channels) and CATV channels, ± 2 ch. is acceptable.

2) In the locations where CATV channels are not available, use ch. 13 instead of ch. W and ch. 7 instead of ch. A-2 for adjustment. If the receiver, adjusted with ch. 13 and 7, is to receive Mid-Band or Super Band channels, the tracking must be readjusted with ch. W and ch. A-2 for the proper tracking of Mid-Band and Super Band.

# FIELD ADJUSTMENTS




## A. SERVICING ADJUSTMENTS

### RF AGC ADJUSTMENT

1. Tune in a local program. (Field strength about 60 dB.)
2. Slowly turn RF AGC control (R107) clockwise from the full counterclockwise position, and set it at a point where noise in the picture is minimized.

### VERTICAL HOLD ADJUSTMENT

Adjust V-Hold control (R401) until vertical movement stops.

### VERTICAL SIZE ADJUSTMENT

Adjust Vertical Size control (R409) until picture becomes symmetrical from top to bottom.

### HORIZONTAL HOLD ADJUSTMENT

Adjust H-Hold control (R506) and set it at the point where horizontal movement (diagonal lines) stops.

### FOCUS ADJUSTMENT

Adjust Focus control to obtain the sharpest and clearest picture.

## B. INTERNAL ADJUSTMENTS

When measuring voltage with a VTVM, be sure to use the test points located on the component side of the circuit boards.

### B+ VOLTAGE (+114V) CONFIRMATION

**(AC POWER SUPPLY)**

1. Connect the receiver to 120V, 60Hz AC power supply and set Bright (R310) and Panabrite (R307) controls to minimum position.
2. Set ColorPilot switch in the OFF position and Service switch to SERVICE position.
3. Connect a voltmeter between TP91 and chassis ground on B-Board (Power Supply Circuit).
4. Confirm that B+ voltage is within a range of +114.0V ± 1.5V.

### B+ VOLTAGE (+114V) ADJUSTMENT

**(DC POWER SUPPLY)**

1. Connect the receiver to DC power supply (+12V) and set Bright (R310) and Panabrite (R307) controls to minimum position.
2. Set ColorPilot switch in the OFF position and Service switch to SERVICE position.
3. Connect a voltmeter between TP91 and chassis ground on B-Board (Power Supply Circuit).
4. Adjust B+ voltage control (R867) to obtain 114.0V ± 0.5V on the voltmeter.

### HIGH VOLTAGE CONFIRMATION

1. Adjust white balance. (See page 10.)
2. Tune in a rainbow color bar signal.
3. Set Bright (R310) and Panabrite (R307) controls to minimum position.
4. Set ColorPilot switch in the OFF position and Service switch to SERVICE position.
5. Using a calibrated high voltage meter (electrostatic type), confirm that High Voltage is within a range of 16.5 kV ± 1.0 kV.

**Note:** Be certain that B+ is 114.0V ± 1.5V during the High Voltage confirmation.

### COLOR PURITY ADJUSTMENT

(See figures 12 and 14.)

1. Operate the receiver for 30 min. with Bright and Panabrite controls at maximum to warm up the CRT.
2. Degauss the receiver fully by using an external degaussing coil.
3. Roughly adjust convergence. (See page 10.)
4. Receive a black and white signal.
5. Turn red and blue Cut Off controls fully counter-clockwise to obtain a green field. Adjust Drive controls if green field is not obtained.
6. Loosen the deflection yoke clamp screw and move the deflection yoke as close to the purity magnet as possible.

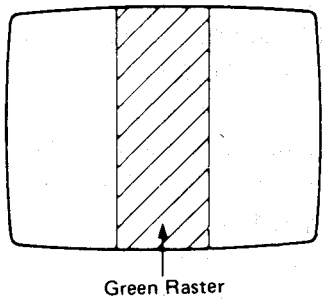



**Figure 12**

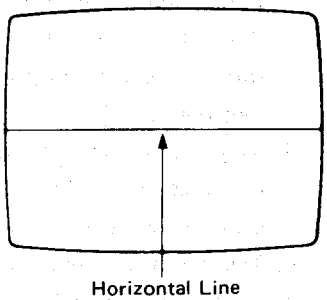



**Figure 13**

7. Loosen purity magnet lock ring (See figure 14.) and adjust the purity magnet to set the vertical green raster precisely at the center of the screen. (See figure 12.) Then tighten the lock ring.
8. Slowly move the deflection yoke forward and adjust for the best overall green screen.
9. Tighten the deflection yoke clamp screw.
10. Produce the blue and red raster by Cut Off controls and observe that good purity is obtained on the respective field.
11. Observe that a uniform white raster is obtained by adjusting R and B Cut Off controls. If the screen is not uniformly white, repeat above procedure.

**Note:** Purity correction magnet may be effective to control purity slightly.

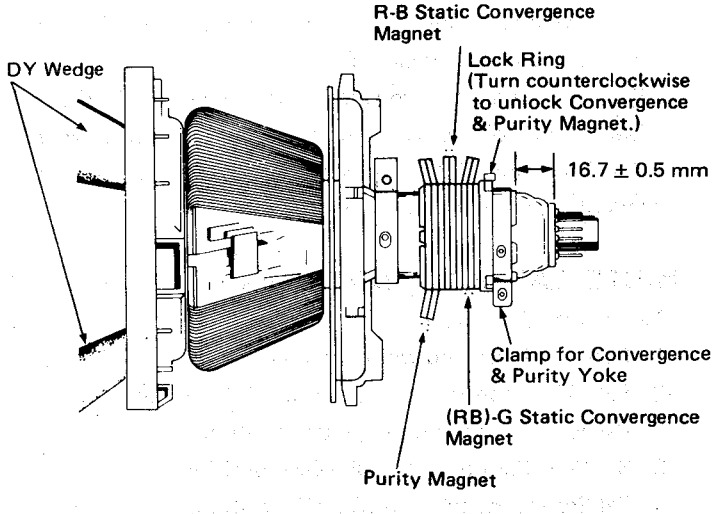

R-B Static Convergence Magnet
DY Wedge
Lock Ring (Turn counterclockwise to unlock Convergence & Purity Magnet.)
16.7 ± 0.5 mm
Clamp for Convergence & Purity Yoke
(RB)-G Static Convergence Magnet
Purity Magnet

**Figure 14**

## CONVERGENCE ADJUSTMENT

**Note:** Before adjusting convergence, vertical size, linearity and focus adjustments must be completed.

1. Connect a dot pattern generator to the set.
2. The brightness level should be no higher than necessary to obtain a clear pattern.
3. Loosen the convergence magnet lock ring and converge the red and blue dots at the center of the screen, by rotating the R-B Static Convergence Magnet. (See figure 14.)
4. Align the converged red/blue dots with the green dots at the center of the screen by rotating the (RB)-G Static Convergence Magnet. (See figure 14.)
5. Tighten the convergence magnet lock ring.
6. Remove the DY wedges (See figure 15.) and slightly tilt (do not rotate) the deflection yoke horizontally and vertically to obtain good overall convergence.
7. Secure the deflection yoke by reinserting the wedges. (See figure 15.)
8. If purity error is found, repeat the purity adjustments.

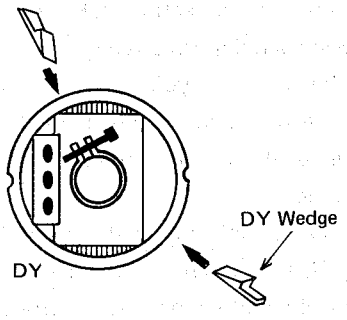



**Figure 15**

**Note:**

1. Two wedges should be fixed approximately in the positions shown in figure 15.
2. Be certain that the two wedges are firmly fixed and the Deflection Yoke is tightly clamped in place. Otherwise the Deflection Yoke may shift its position and cause a loss of convergence and purity.

## WHITE BALANCE ADJUSTMENT

(See figures 13 and 16.)

1. Tune in a black and white program.
2. Set Tint control to center and Color, Bright and Panabrite controls to minimum position.
3. Set ColorPilot Switch in the OFF position.
4. Set Service Switch to SERVICE position.
5. Turn two Cut Off controls (R, B on C-Board) fully counterclockwise.
6. Connect VTVM between collector of Q353 and chassis ground. Then adjust Bright, Panabrite and ABL controls to obtain 100V on the VTVM.
7. Slowly turn the Screen control clockwise from the full counterclockwise position until a dim green horizontal line appears on the picture tube.
8. Make the horizontal line white by turning Red and Blue Cut Off controls clockwise.
9. Return Service switch to NORMAL position.
10. Alternately adjust Red and Blue Drive controls to produce a normal black and white picture. Check the black and white picture detail for proper black and white retention (no coloration) from lowlights to highlights and at all brightness levels for proper tracking. Proper tracking at all brightness levels can be obtained when Screen control, Cut Off controls, and Drive controls are properly adjusted. If the results are unsatisfactory, repeat all the above steps.

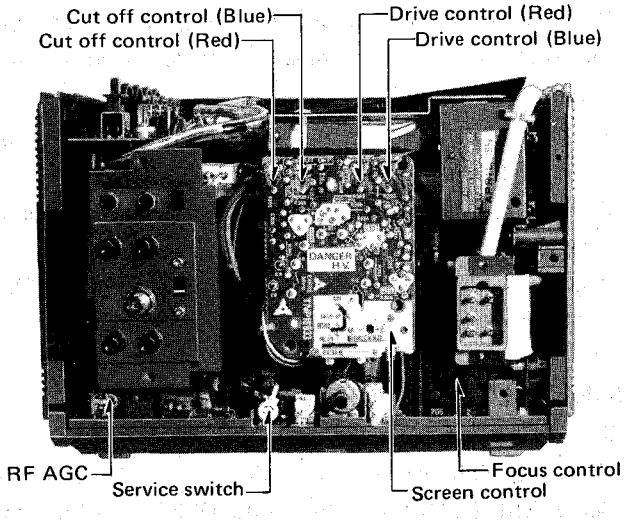



**Figure 16**

## ABL CONTROL ADJUSTMENT

This is factory aligned. Usually no further alignment is required in the field. However, when the A-Board, C-Board or CRT is replaced, the following alignment is necessary:

1. Receive a cross hatch pattern signal from the signal generator.
2. Turn Brightness and Panabrite controls to maximum.
3. Set ColorPilot switch to OFF position.
4. Connect a DC voltmeter between TP86 and TP87 (negative lead to TP86 and positive lead to TP87).
5. Adjust ABL control (R312) to obtain a voltmeter reading of 6.9V to obtain proper picture brightness.

**Note:** For this adjustment NTSC Pattern Generator, model LCG-396 manufactured by Leader Electronics Corp. (Japan) is recommended.

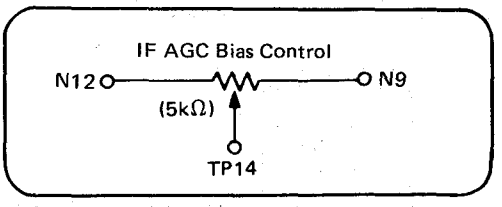
# GENERAL ALIGNMENT

**Note:** 1. During alignment, use a non-metallic screwdriver to prevent a short-circuit.
2. A transformer core which has two tuning peak points should be adjusted at the lower position in the bobbin.

## 45.75 MHz TUNING TRANSFORMER ALIGNMENT

**Preparation**

1. Set up sweep and marker generator, oscilloscope and power supply as shown in figure 17.
2. Set up AGC Bias control (5kΩ) as shown in figure 17.



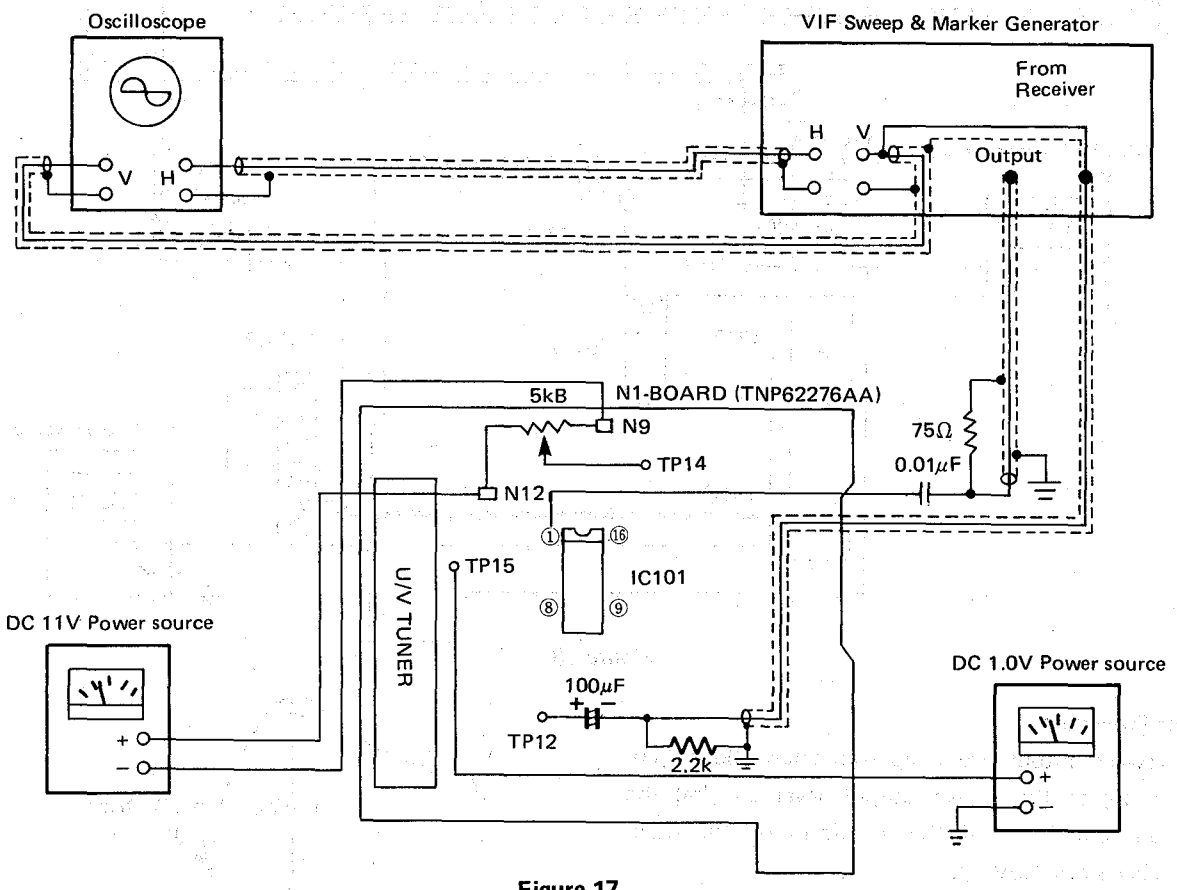




**Figure 17**

**Alignment Procedure**

1. Set the sweep output level to 100mVp-p.
2. Adjust the IF-AGC Bias control (5kΩ) to achieve a Detector output voltage of 200mVp-p on oscilloscope.
3. Adjust T101 for maximum wave amplitude at 45.75MHz. (See figure 18.)

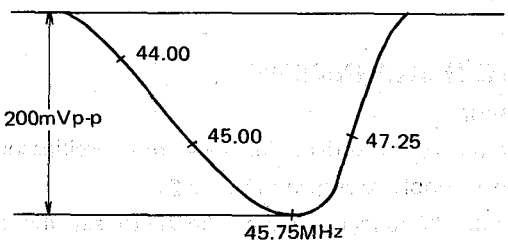
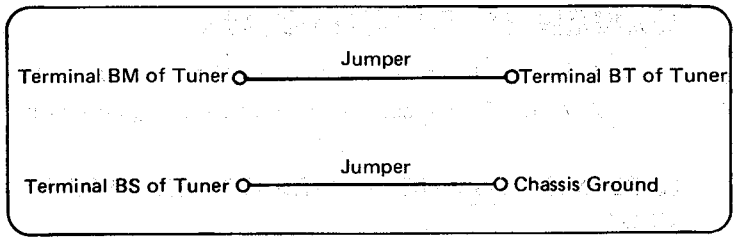



**Figure 18**

## 47.25 MHz TRAP ALIGNMENT

**Preparation**

1. Set up sweep and marker generator, oscilloscope, and power supply as shown in figure 19.
2. Rotate "Channel Tuning" knob to set the channel indicator at VHF high position.
3. Connect jumpers as shown in figure 19.



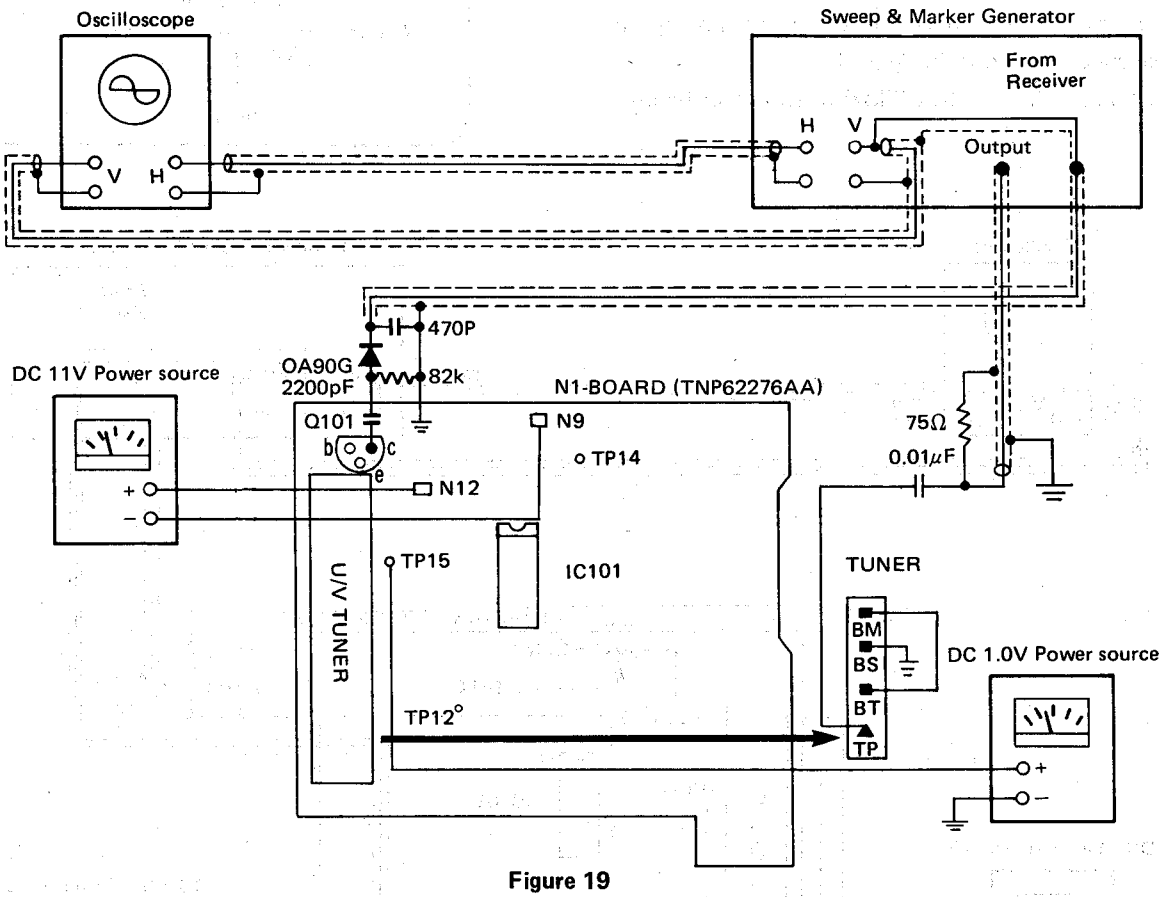




**Figure 19**

**Alignment Procedure**

1. Set the sweep output level to approximately 100 mVp-p.
2. Slightly adjust the sweep output level so that the maximum amplitude of the waveform on the oscilloscope becomes 1.0Vp-p.
3. Adjust T103 for minimum wave amplitude at 47.25 MHz. (See figure 20.)

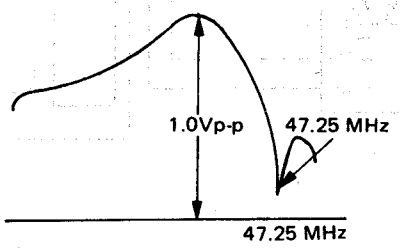
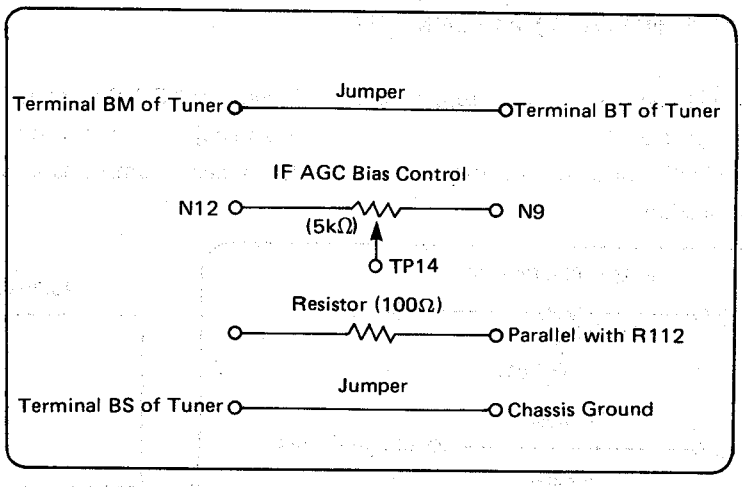



**Figure 20**

## VIDEO IF ALIGNMENT

**Preparation**

1. Set up sweep and marker generator, oscilloscope, and power supply as shown in figure 21.
2. Rotate "Channel Tuning" knob to set the channel indicator at VHF high position.
3. Set up AGC Bias control (5kΩ) as shown in figure 21.
4. Connect resistor (100Ω) in parallel with R112.
5. Connect jumpers as shown in figure 21.



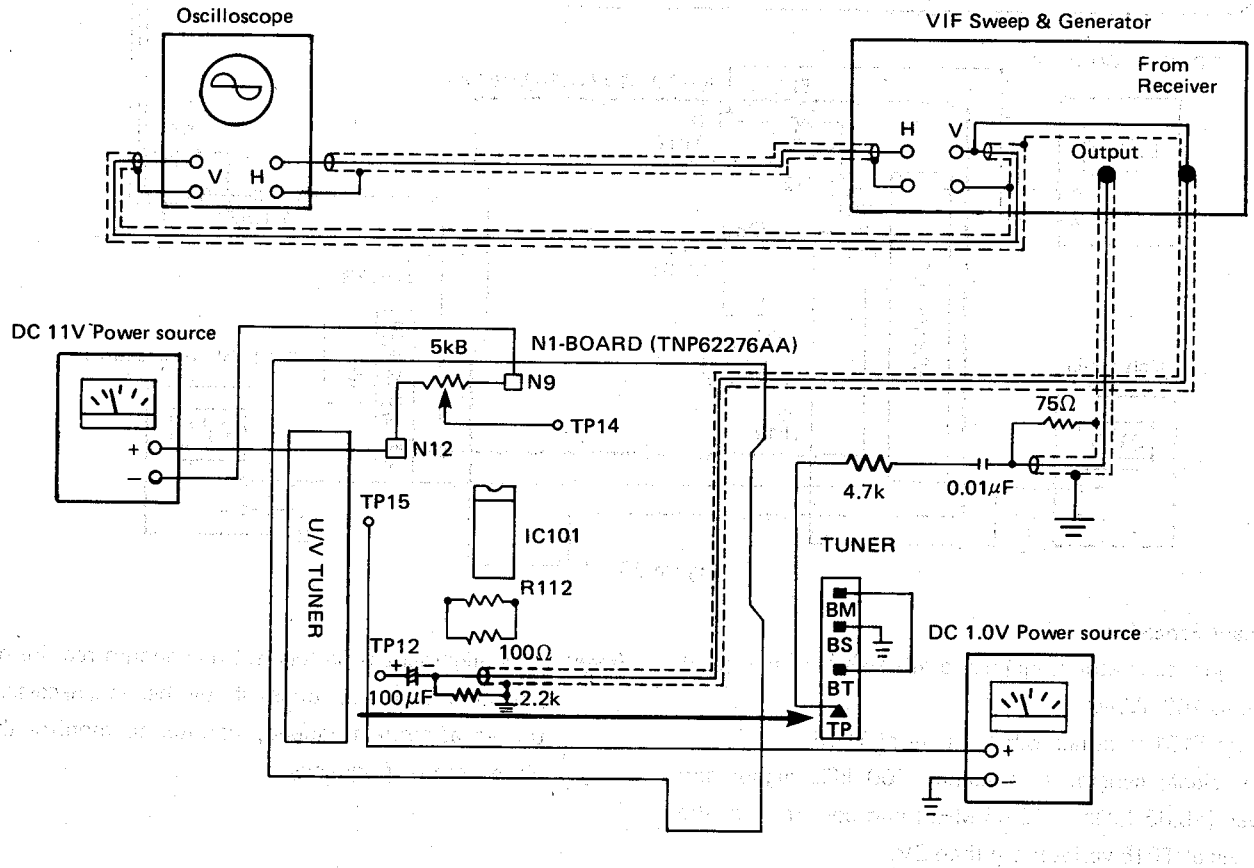




**Figure 21**

**Alignment Procedure**

1. Set the sweep generator output level to 100mVp-p.
2. Adjust the bias voltage at TP14 for maximum signal gain. Then decrease the bias voltage to decrease the detector output voltage at TP12 until it becomes 1.0Vp-p on oscilloscope.
3. Adjust tuner converter coil to achieve a waveform as that of figure 22 with maximum amplitude at 44 MHz.
4. Make sure that there is no spurious oscillation by varying sweep output by ± 15 dB and adjusting IF AGC Bias control.

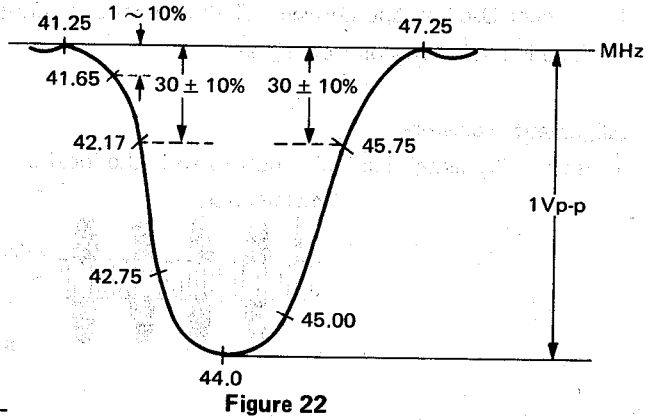



**Figure 22**

## AUTOMATIC FINE TUNING (AFT) ALIGNMENT

**Preparation**

1. Set up 45.75 MHz signal generator, power supply and voltmeter as shown in figure 23.
2. Rotate "Channel Tuning" knob to set the channel indicator at VHF high position.
3. Set up AGC Bias control (5kΩ) as shown in figure 23 and adjust it for approximately 8.0V at TP14.
4. Connect a jumper as shown in figure 23.

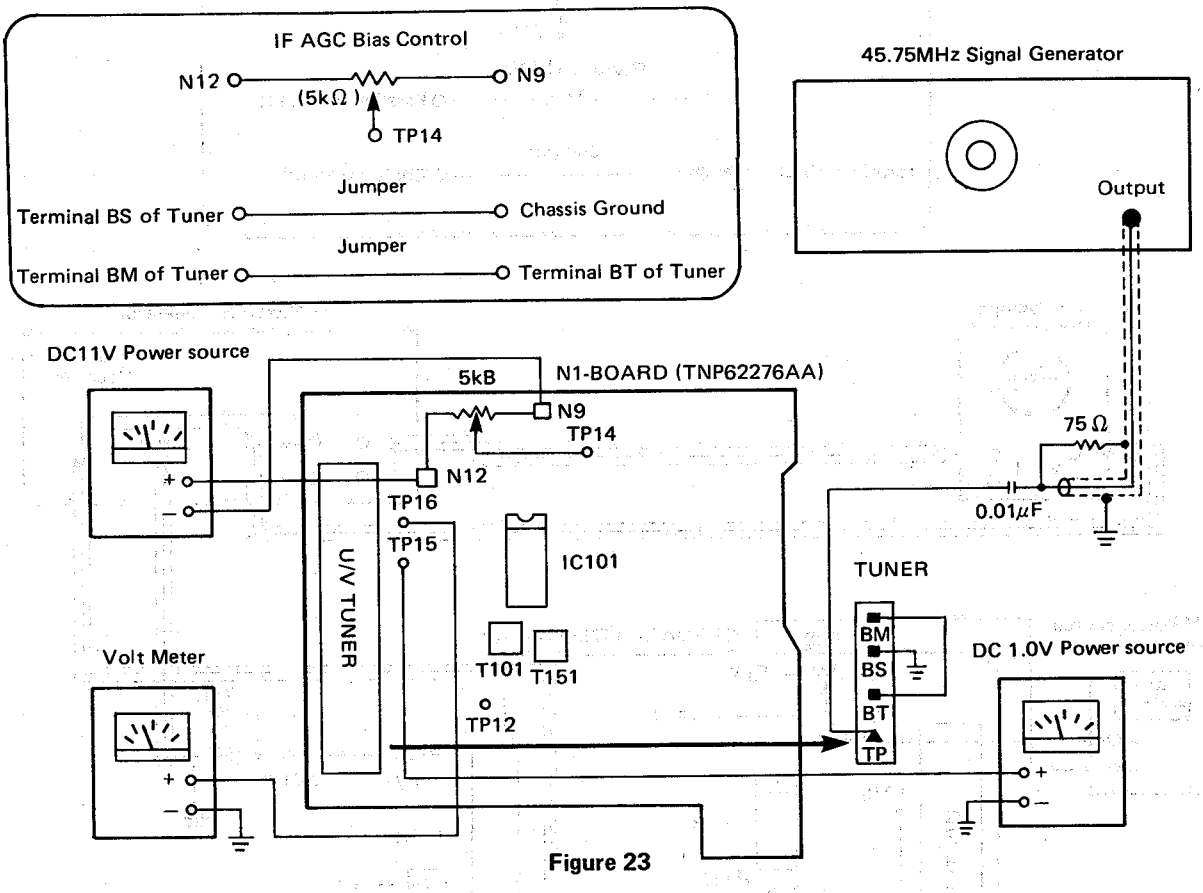



**Figure 23**

**Alignment Procedure**

1. Set signal generator frequency at 45.75 MHz and output level to 100mVp-p.
2. Adjust T151 to obtain 6.5V ± 1.0V at TP16.
3. Vary signal generator frequency 100 kHz higher and lower (45.65 MHz – 45.85 MHz) and confirm that the voltage at TP16 varies more than 2V.

**Note:** This alignment is factory set and should require no adjustment. If adjustment should become necessary use an accurate frequency counter to monitor the RF generator frequency.

## 4.5 MHz TRAP ALIGNMENT

**Preparation**

1. Connect Oscilloscope between TP12 and chassis ground.
2. Tune in a rainbow color bar signal.

**Alignment Procedure**

1. Rotate "Channel Tuning" knob to shift the local oscillator to a higher frequency so that the waveform shown in figure 24 is obtained.
2. Set T102 to minimize the amplitude of 4.5 MHz beat.
3. Rotate "Channel Tuning" knob back and again tune in a rainbow color bar signal.

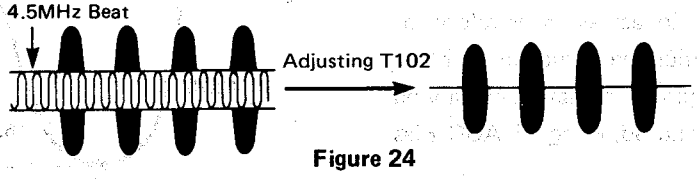
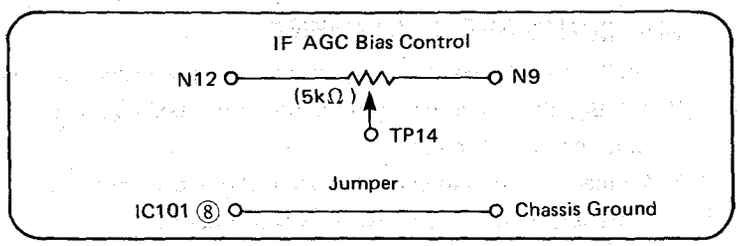



**Figure 24**

## SOUND IF ALIGNMENT

**Preparation**

1. Set up sweep and marker generator, power supply and oscilloscope as shown in figure 25.
2. Set up AGC Bias control (5kΩ) as shown in figure 25.
3. Connect a jumper as shown in figure 25.



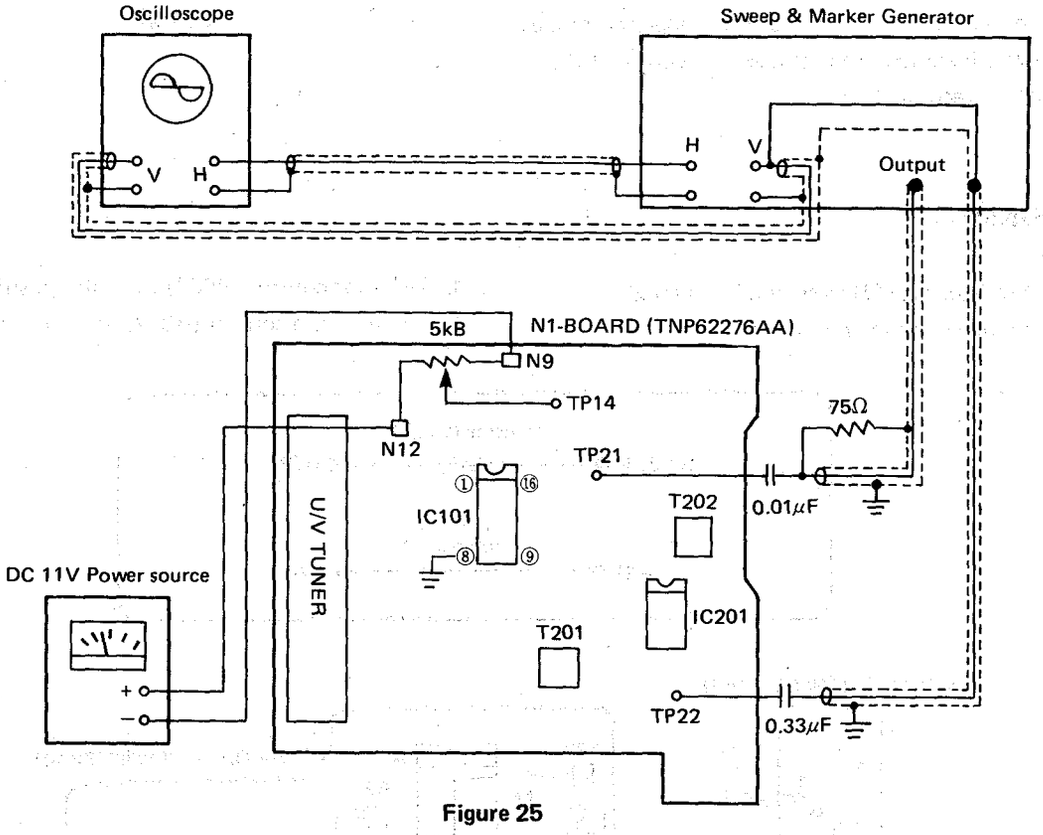




**Figure 25**

**Alignment Procedure**

1. Cut IF circuit function off by setting attached AGC Bias control to minimum or set AGC Bias voltage supplied by D.C. power source to zero volts at TP14.
2. Set sweep generator output level to 6 mVr.m.s. and adjust T201 to obtain the maximum amplitude as shown in figure 26.
3. Adjust T202 to obtain the maximum amplitude at 4.5 MHz as shown in figure 26.
4. Adjust T201 again to achieve the waveform as shown in figure 27 (a = b).
5. Set sweep generator output level to 16 mVrms.
6. Confirm that the waveform line between +90 kHz and −90 kHz point is straight as shown in figure 27.
   (There should be no distortion in the range of ±100 kHz.)

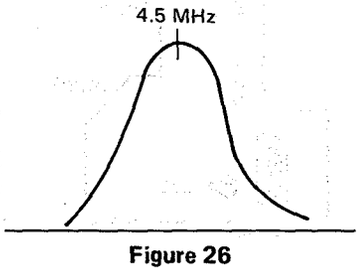



**Figure 26**

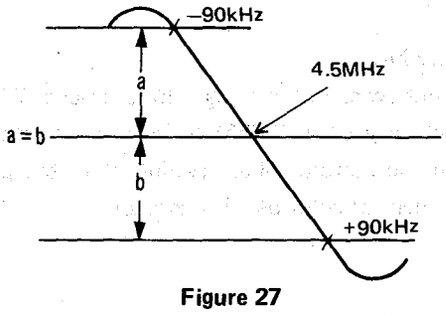



**Figure 27**

## SUB-CONTRAST ALIGNMENT

1. Apply a studio color bar signal from a signal generator.
2. Set Brightness and Panabrite controls to maximum and Color control to minimum.
3. Connect an oscilloscope between Q353 base and C5 (chassis ground) on CRT Neck PCB (C-Board).
4. Adjust Sub-Contrast control (R302) to obtain 3.0Vp-p ± 0.1Vp-p from the white level (100%) to the pedestal level. (See figure 28.)

**Note:** For this adjustment NTSC Pattern Generator, model LCG-396 manufactured by Leader Electronics Corp. (Japan) is recommended.

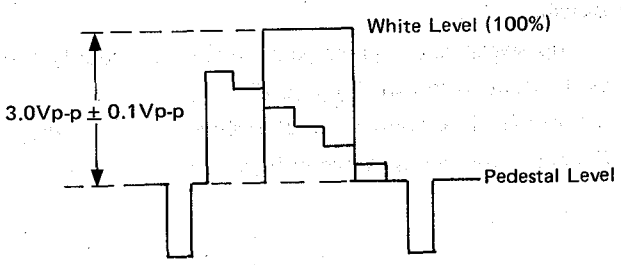



**Figure 28**

## APC ALIGNMENT

**Preparation**

1. Connect a resistor (15kΩ) as shown in figure 29.
2. Connect a jumper as shown in figure 29.
3. Set Color control (R604) to center position.
4. Set Panabrite control (R307) to maximum position.

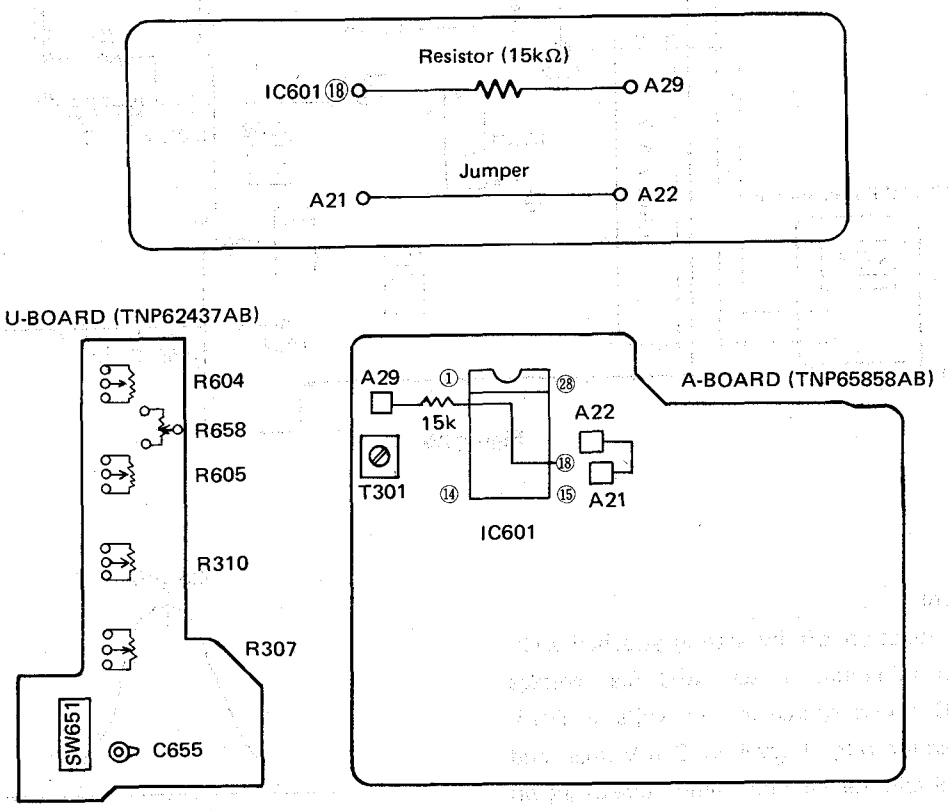



**Figure 29**

**Alignment Procedure**

1. Receive a rainbow color bar signal. (Input level of 70 dB.)
2. Turn trimmer capacitor (C655) to keep color synchronization on the picture tube. (Adjust it to the point where movement of color bars just stops.)
3. Disconnect resistor and jumper and confirm that color synchronization holds.
4. Change channels and confirm that color synchronization holds.

## SUB COLOR & COLOR PHASE ALIGNMENT

**Preparation**

1. Connect an oscilloscope to the base of Q352 (ground to C5).
2. Set ColorPilot switch (SW651) to OFF position.
3. Set Color (R604), Bright (R310) and Panabrite (R307) controls to maximum position.

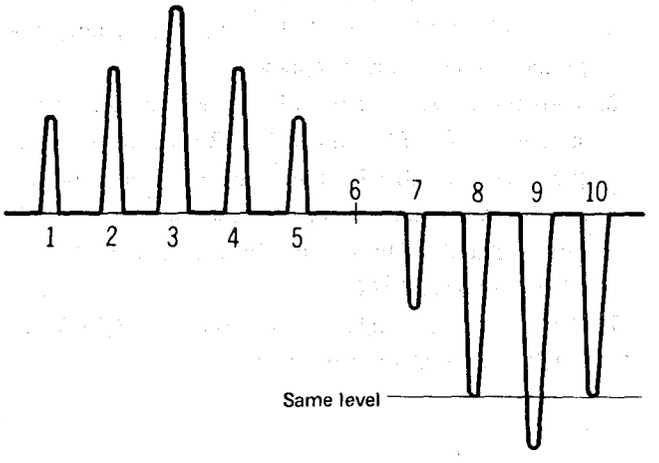



Figure 30

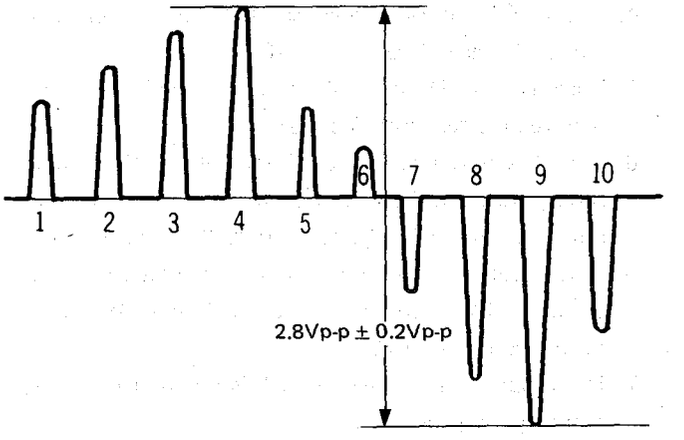



Figure 31

**Alignment Procedure**

1. Receive a rainbow color bar signal.
2. Adjust Tint control (R605) to achieve the waveform shown in figure 30.
3. Set ColorPilot switch (SW651) to ON position.
4. Adjust Sub-Color control (R658) to achieve a voltage of 2.8Vp-p ± 0.2Vp-p as shown in figure 31.
5. Turn Tint control (R605) and confirm that variable range is more than 20°.
6. Set ColorPilot switch (SW651) to OFF position.
7. Turn Tint control (R605) and confirm that variable range is more than 60°.

## ADDP ALIGNMENT

**Preparation** (See figure 32.)

1. Connect a 12V or 24V DC power supply between B22 and ground (B17).

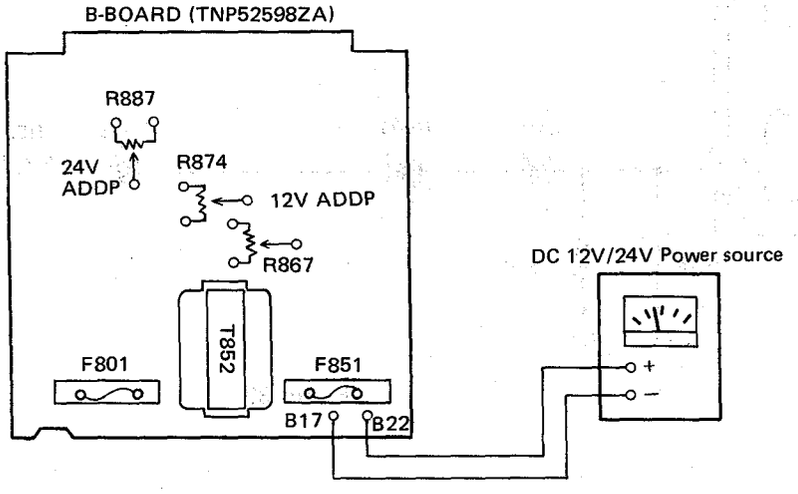



Figure 32

**Alignment Procedure**

1. 12V ADDP adjustment
   1. Receive a black and white signal under normal reception conditions.
   2. Turn Panabrite (R307) and Bright (R310) controls to maximum and sound control (R212) to minimum.
   3. Turn 12V ADDP control (R874) completely counter-clockwise.
   4. Adjust DC power supply so that voltage between input terminals (B22, B17) is 10.4V.
   5. Turn 12V ADDP control clockwise slowly until the picture on screen just disappears.
   6. Turn the power switch OFF and set the DC power supply between B22 and B17 to 12V, then turn the power switch ON again. Gradually decrease the supply voltage and confirm normal operation of the set at 10.5V. Check that the set turns OFF at a supply voltage of 10.3V.
   7. If the operation range of ADDP is not 10.4V ± 0.1V, repeat above procedure.
2. 24V ADDP Adjustment (to be done after 12V ADDP adjustment.)
   1. & 2. Same as steps 1 and 2 in Section 1.
   3. Turn 24V ADDP control (R887) completely counter-clockwise.
   4. Adjust DC power supply so that voltage between input terminals (B22, B17) is 22.8V.
   5. Turn 24V ADDP control clockwise slowly until the picture on screen just disappears.
   6. Turn the power switch OFF and set the DC power supply between B22 and B17 to 24V, and then turn the power switch ON again. Gradually decrease the supply voltage and confirm normal operation of the set at 22.9V. Check that the set turns OFF at a supply voltage of 22.6V.
   7. If the operation range of ADDP is not 22.8V + 0.1V, −0.2V, repeat above procedure.

# CIRCUIT EXPLANATION

## HORIZONTAL OSC. DISABLE CIRCUIT

(See figure 33.)

1. Under normal operation conditions, zener diode D505 is Cut Off since its breakdown voltage is not reached.
2. When the amplitude of the pulse applied to diode D503 increases, the cathode voltage of zener diode D505 rises, and D505 conducts.
3. The conduction of D505 increases the voltage at pin 5 of IC401.
   This causes the Horizontal Oscillator Circuit to stop and reduces the high voltage to zero.

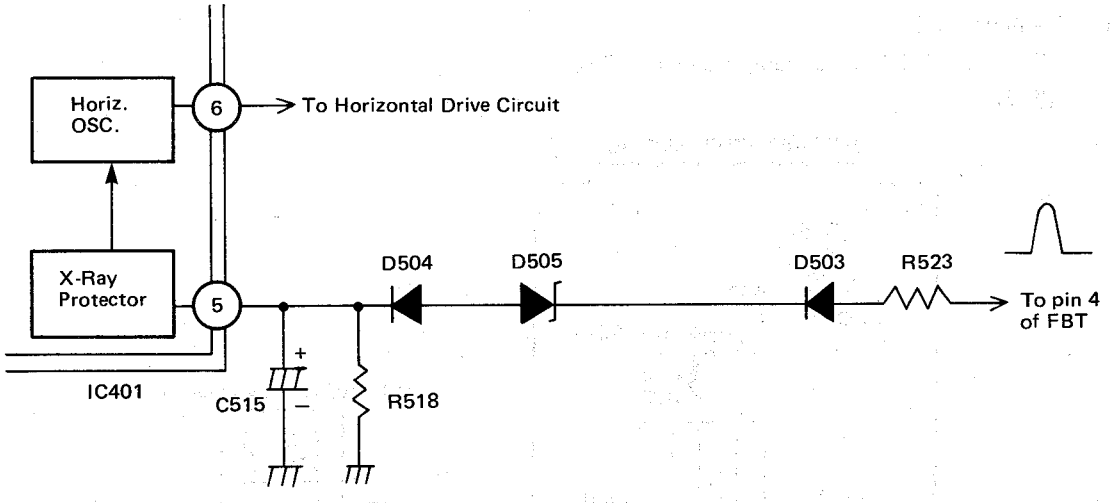
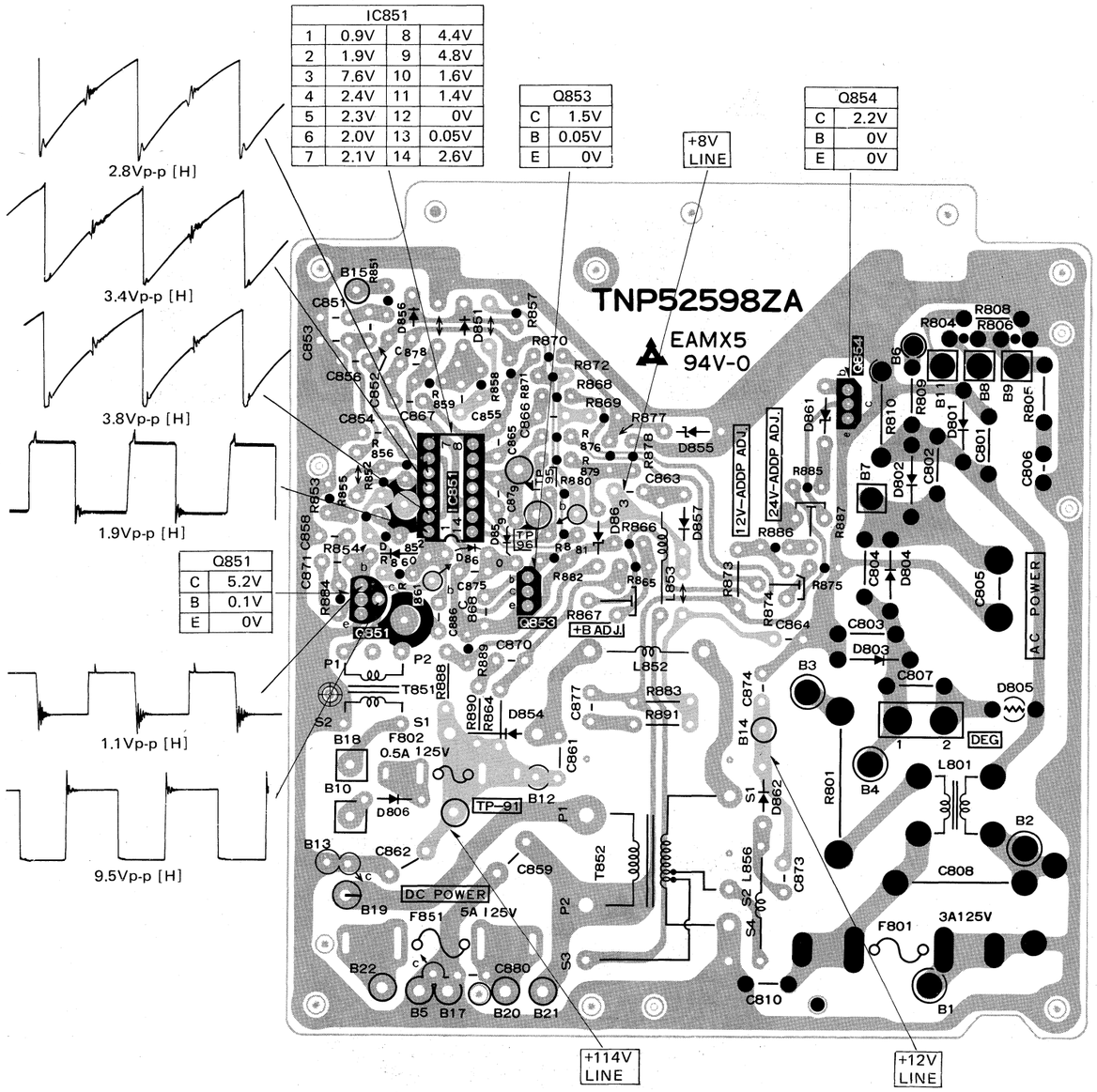


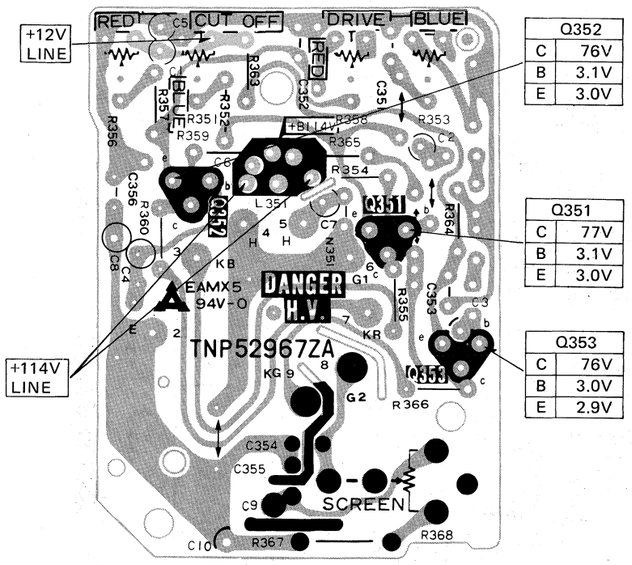

**Figure 33**

# CONDUCTOR VIEWS

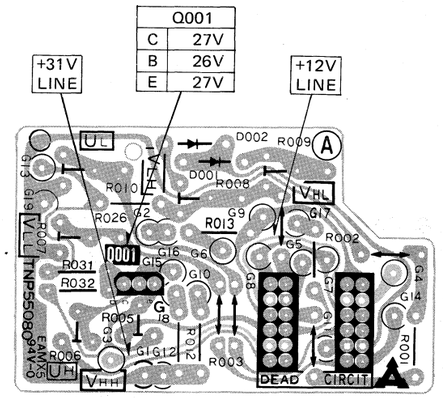
## B-BOARD
## TNP52598ZA



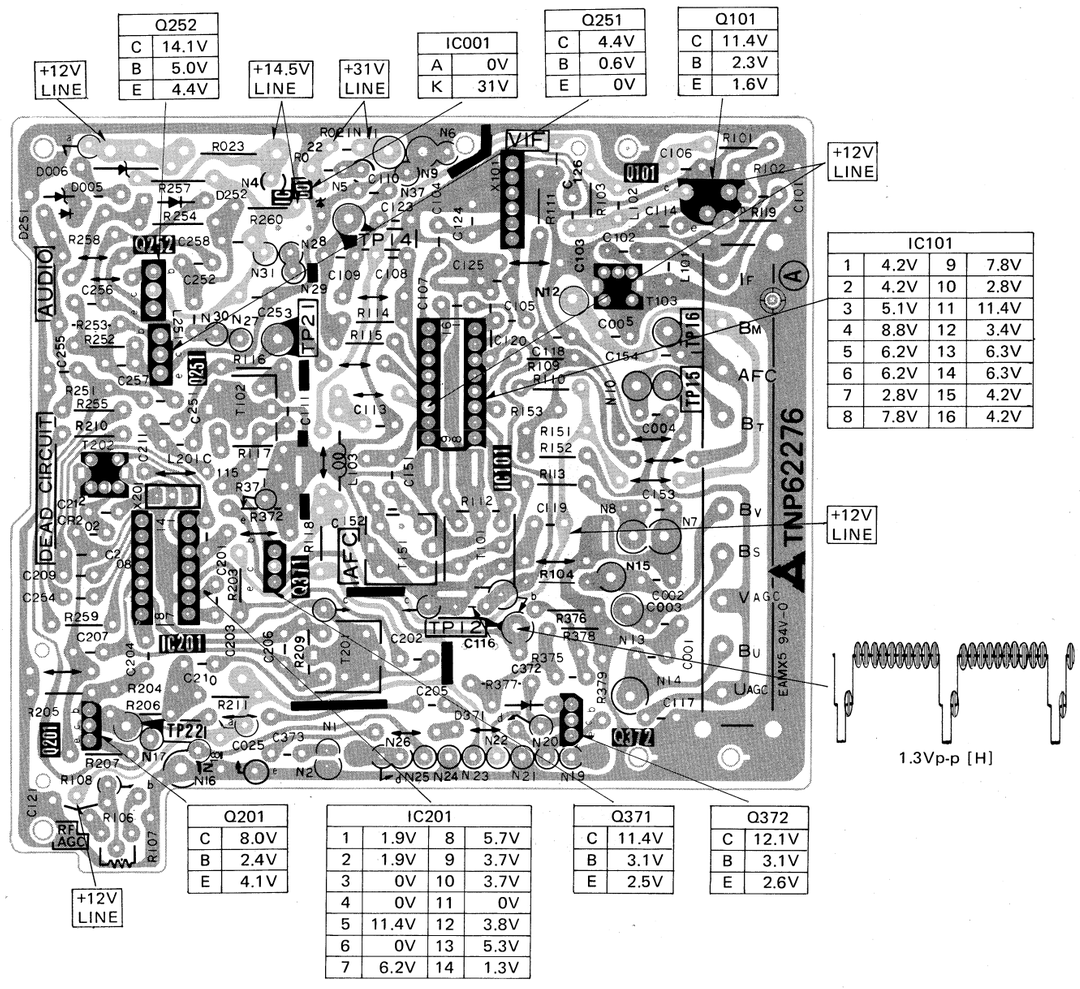

## C-BOARD
## TNP52967ZA




## G-BOARD
## TNP55080ZA



## N1-BOARD
## TNP62276AA




| Q252 | |
|---|---|
| C | 14.1V |
| B | 5.0V |
| E | 4.4V |

| IC001 | |
|---|---|
| A | 0V |
| K | 31V |

| Q251 | |
|---|---|
| C | 4.4V |
| B | 0.6V |
| E | 0V |

| Q101 | |
|---|---|
| C | 11.4V |
| B | 2.3V |
| E | 1.6V |

| IC101 | | | |
|---|---|---|---|
| 1 | 4.2V | 9 | 7.8V |
| 2 | 4.2V | 10 | 2.8V |
| 3 | 5.1V | 11 | 11.4V |
| 4 | 8.8V | 12 | 3.4V |
| 5 | 6.2V | 13 | 6.3V |
| 6 | 6.2V | 14 | 6.3V |
| 7 | 2.8V | 15 | 4.2V |
| 8 | 7.8V | 16 | 4.2V |

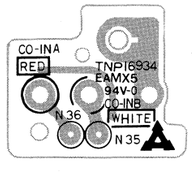
| Q201 | |
|---|---|
| C | 8.0V |
| B | 2.4V |
| E | 4.1V |

| IC201 | | | |
|---|---|---|---|
| 1 | 1.9V | 8 | 5.7V |
| 2 | 1.9V | 9 | 3.7V |
| 3 | 0V | 10 | 3.7V |
| 4 | 0V | 11 | 0V |
| 5 | 11.4V | 12 | 3.8V |
| 6 | 0V | 13 | 5.3V |
| 7 | 6.2V | 14 | 1.3V |

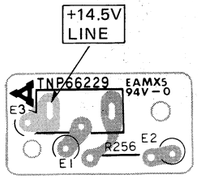
| Q371 | |
|---|---|
| C | 11.4V |
| B | 3.1V |
| E | 2.5V |

| Q372 | |
|---|---|
| C | 12.1V |
| B | 2.6V |
| E | 2.6V |

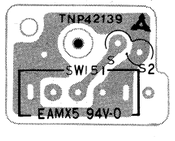
## N2-BOARD
## TNP16934ZA



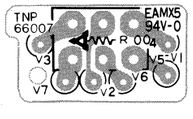

## E-BOARD
## TNP66229ZA



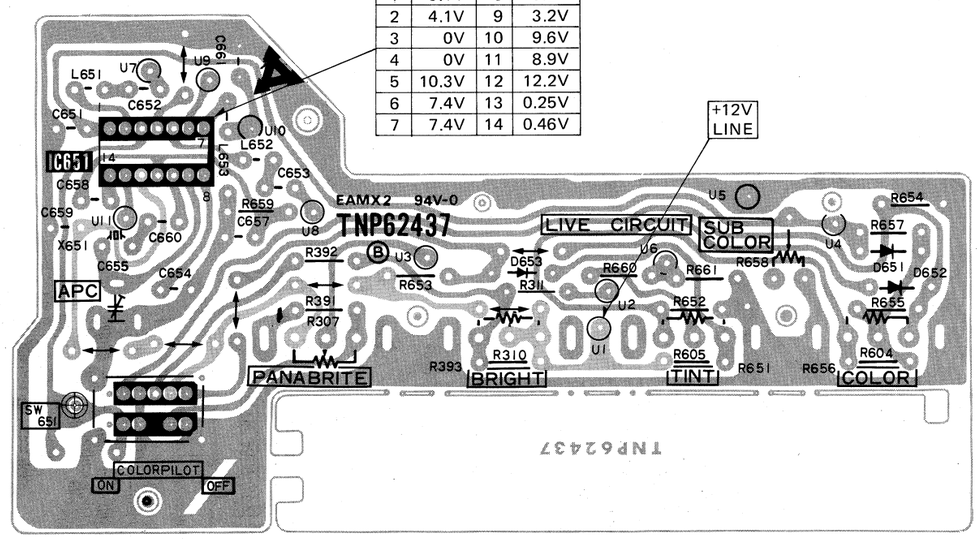

## S-BOARD
## TNP42139ZA




## V-BOARD
## TNP66007ZA

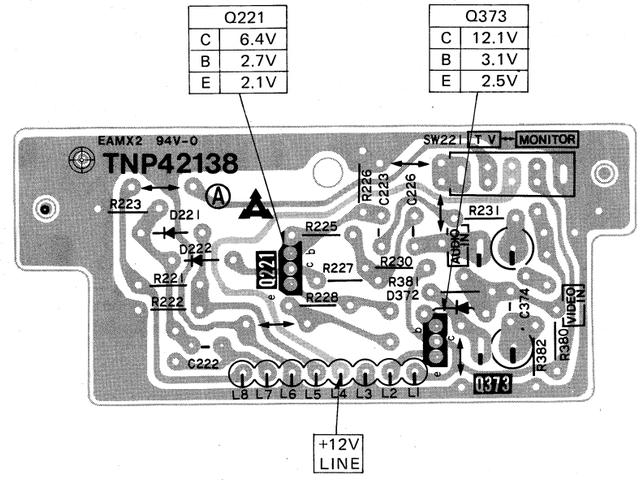



## U-BOARD
## TNP62437AB




| IC651 | | | |
|---|---|---|---|
| 1 | 3.1V | 8 | 3.2V |
| 2 | 4.1V | 9 | 3.2V |
| 3 | 0V | 10 | 9.6V |
| 4 | 0V | 11 | 8.9V |
| 5 | 10.3V | 12 | 12.2V |
| 6 | 7.4V | 13 | 0.25V |
| 7 | 7.4V | 14 | 0.46V |

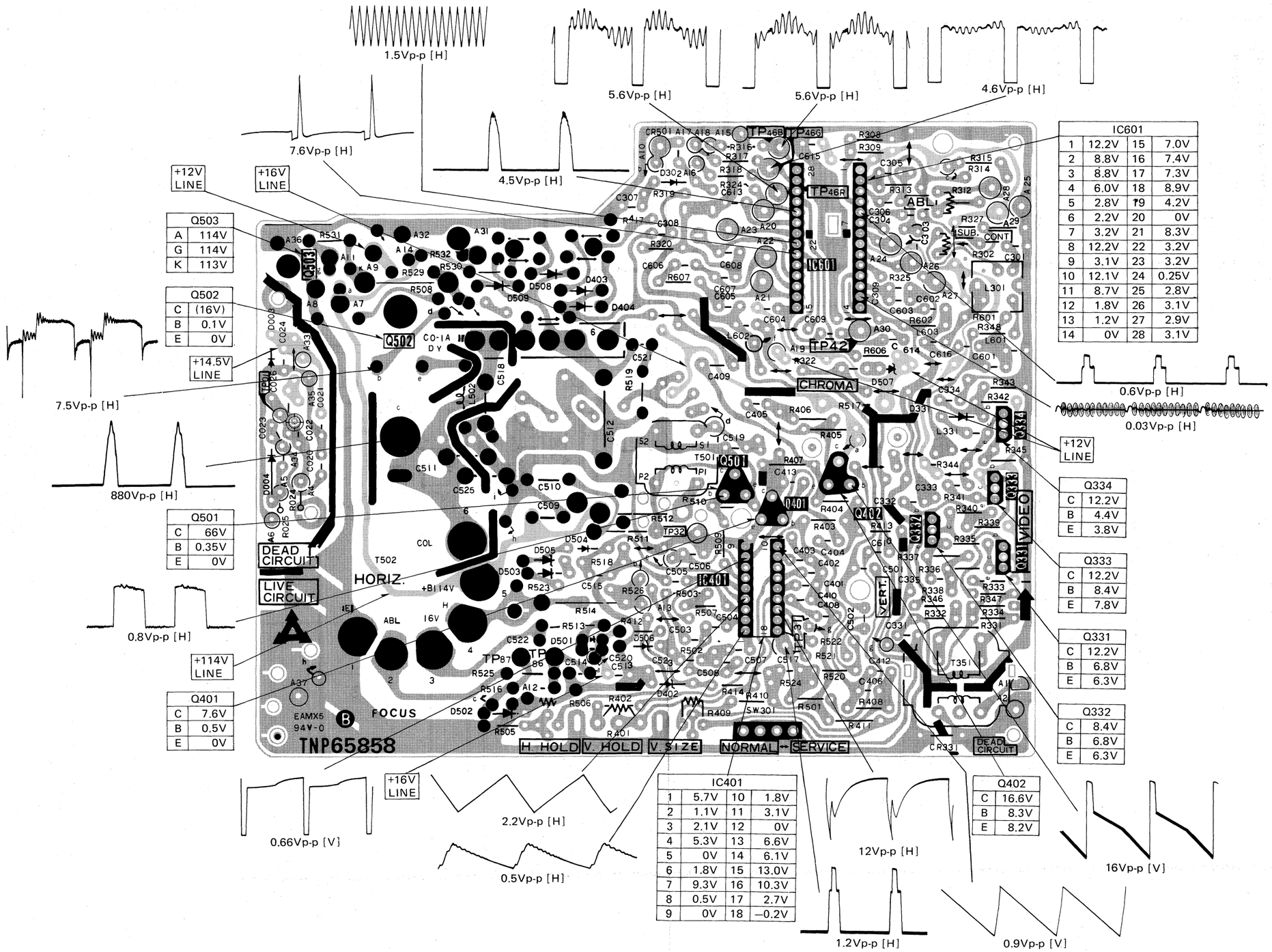
## L-BOARD
## TNP42138ZA




| Q221 | |
|---|---|
| C | 6.4V |
| B | 2.7V |
| E | 2.1V |

| Q373 | |
|---|---|
| C | 12.1V |
| B | 3.1V |
| E | 2.5V |

## A-BOARD
## TNP65858AB




| Q503 | |
|---|---|
| A | 114V |
| G | 114V |
| K | 113V |

| Q502 | |
|---|---|
| C | (16V) |
| B | 0.1V |
| E | 0V |

| Q501 | |
|---|---|
| C | 66V |
| B | 0.35V |
| E | 0V |

| Q401 | |
|---|---|
| C | 7.6V |
| B | 0.5V |
| E | 0V |

| IC601 | | | |
|---|---|---|---|
| 1 | 12.2V | 15 | 7.0V |
| 2 | 8.8V | 16 | 7.4V |
| 3 | 8.8V | 17 | 7.3V |
| 4 | 6.0V | 18 | 8.9V |
| 5 | 2.8V | 19 | 4.2V |
| 6 | 2.2V | 20 | 0V |
| 7 | 3.2V | 21 | 8.3V |
| 8 | 12.2V | 22 | 3.2V |
| 9 | 3.1V | 23 | 3.2V |
| 10 | 12.1V | 24 | 0.25V |
| 11 | 8.7V | 25 | 2.8V |
| 12 | 1.8V | 26 | 3.1V |
| 13 | 1.2V | 27 | 2.9V |
| 14 | 0V | 28 | 3.1V |

| Q334 | |
|---|---|
| C | 12.2V |
| B | 4.4V |
| E | 3.8V |

| Q333 | |
|---|---|
| C | 12.2V |
| B | 8.4V |
| E | 7.8V |

| Q331 | |
|---|---|
| C | 12.2V |
| B | 6.8V |
| E | 6.3V |

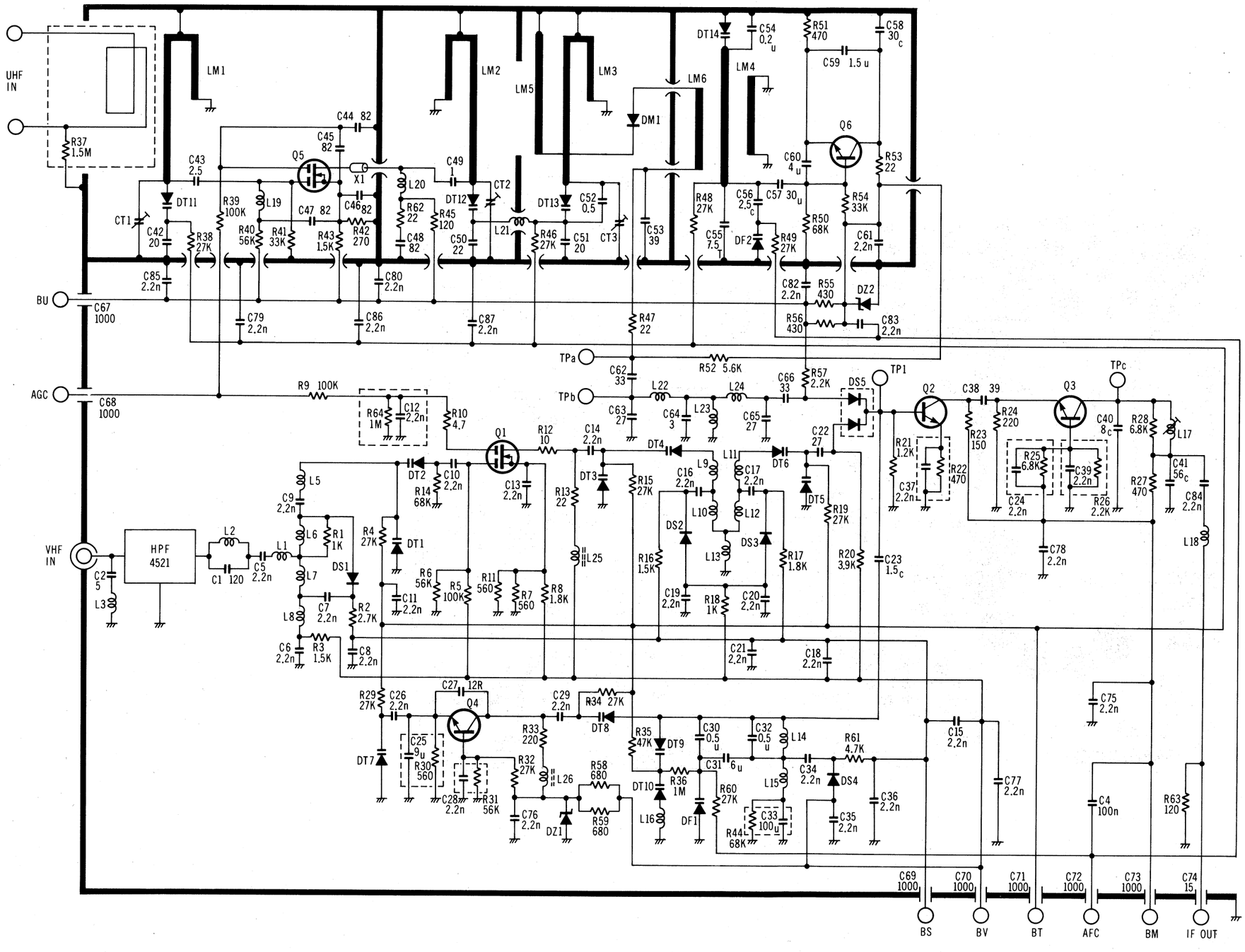
| Q332 | |
|---|---|
| C | 8.4V |
| B | 6.8V |
| E | 6.3V |

| IC401 | | | |
|---|---|---|---|
| 1 | 5.7V | 10 | 1.8V |
| 2 | 1.1V | 11 | 3.1V |
| 3 | 2.1V | 12 | 0V |
| 4 | 5.3V | 13 | 6.6V |
| 5 | 0V | 14 | 6.1V |
| 6 | 1.8V | 15 | 13.0V |
| 7 | 9.3V | 16 | 10.3V |
| 8 | 0.5V | 17 | 2.7V |
| 9 | 0V | 18 | −0.2V |

| Q402 | |
|---|---|
| C | 16.6V |
| B | 8.3V |
| E | 8.2V |

# SCHEMATIC DIAGRAM

## U/V TUNER TNV56471F2

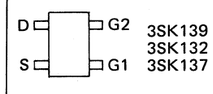



### TERMINAL SUPPLY VOLTAGE

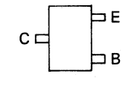
| Terminal Name | Supply Voltage | | |
|---|---|---|---|
| | VHF | | UHF |
| | LOW | HIGH | |
| BU | —— | | 12.0V |
| AGC | 7.5V | | 7.5V |
| BS | 30V | 0V | 0V/30V |
| BV | 12.0V | | —— |
| BT | 0.8V ~ 29V | | |
| AFC | 6.5V ± 4V | | |
| BM | 12.0V | | |

### SYMBOL

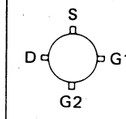
| Symbol | Symbol No. | Semiconductor |
|---|---|---|
| | DT1 ~10 | MA329, 1SV177, TX287 |
| | DT11 ~14 | MA325, 1S2208 |
| | DF1 | MA341, MA342, RLV12 |
| | DF2 | HVK89, MA342, RLV11 |
| | DZ1 ~2 | HZL004, RLZ8.2, MA6082 RLZ9.1A |
| | DS1 ~4 | MA72, RLS135, HSK110 |
| | DS5 | MC804/MA72 |
| | DM1 | HSK151, 1SS242 |
| | Q1 | 3SK139, 3SK132, 3SK137 |
| | Q2 | 2SC3130, 2SC2757, 2SC2735 |
| | Q3 | 2SC2404, 2SC2620, 2SC3125 |
| | Q4 | 2SC2759, 2SC3130, 2SC2736 |
| | Q5 | 3SK142, 3SK103, 3SK123 |
| | Q6 | 2SC3130, 2SC2736, 2SC3445 |



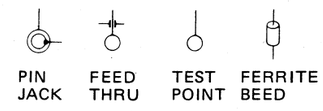

3SK139
3SK132
3SK137




2SC3130, 2SC3125
2SC2757, 2SC2736
2SC2735, 2SC3545
2SC2404, 2SC2620




3SK142
3SK103
3SK123



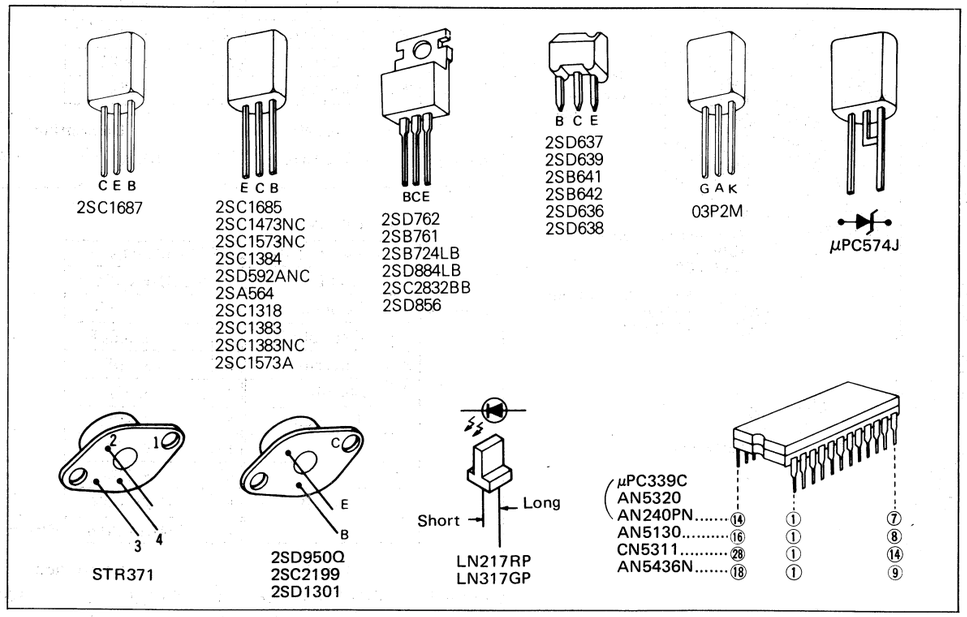
# SCHEMATIC DIAGRAM FOR MODEL CTG-713 (CHASSIS NO. NMX-K82D)

**IMPORTANT SAFETY NOTICE**

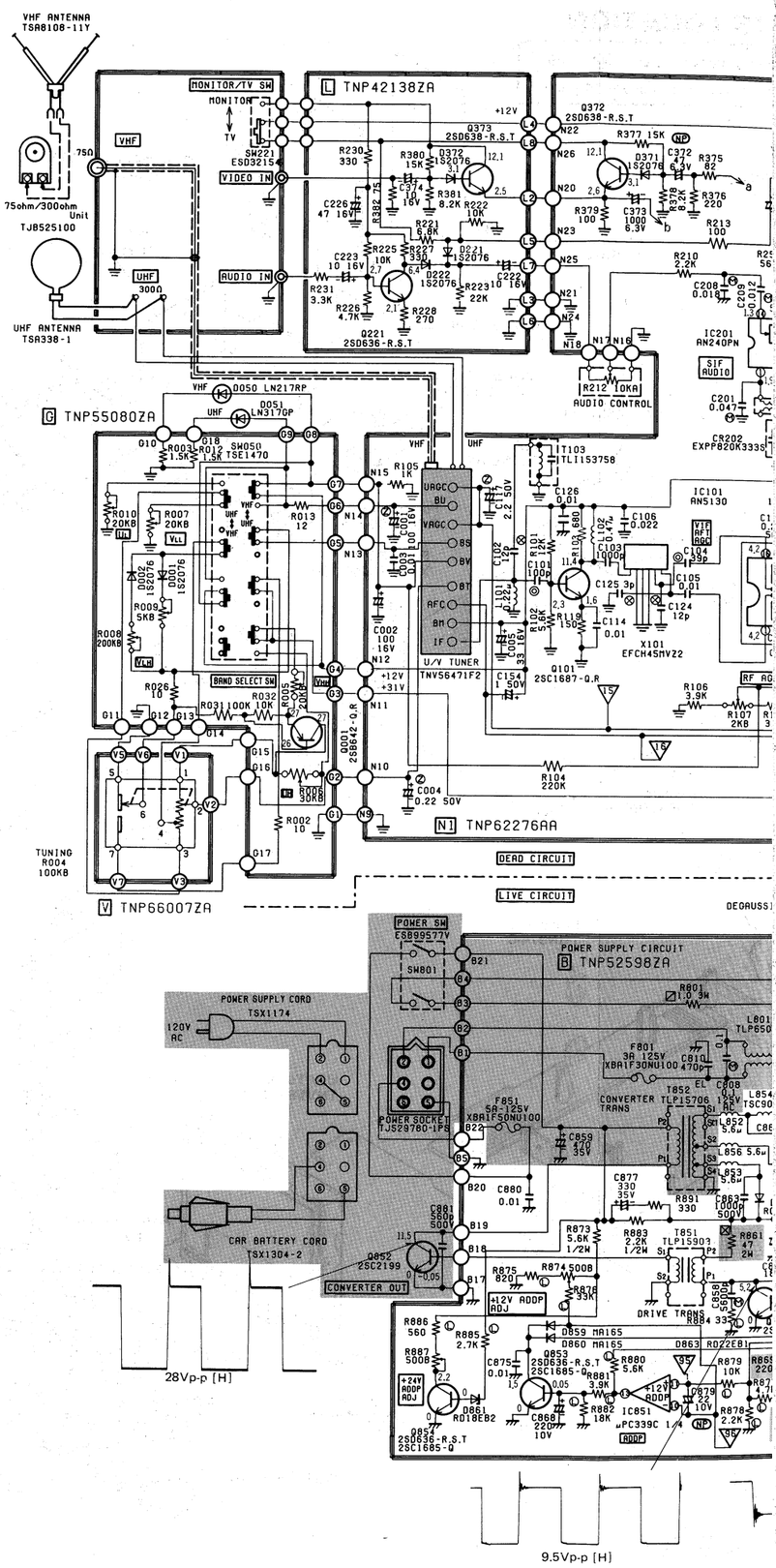
THE SHADED AREA ON THIS SCHEMATIC DIAGRAM INCORPORATES SPECIAL FEATURES IMPORTANT FOR PROTECTION FROM X—RADIATION, FIRE AND ELECTRICAL SHOCK HAZARDS. WHEN SERVICING IT IS ESSENTIAL THAT ONLY MANUFACTURER'S SPECIFIED PARTS BE USED FOR THE CRITICAL COMPONENTS IN THE SHADED AREAS OF THE SCHEMATIC.

**NOTE:**

1. All resistors are carbon 1/4W resistor, unless otherwise noted with the following marks.
   Unit of resistance is OHM (Ω), (K = 1,000, M = 1,000,000).
   - △ : Solid
   - ▭ : Wire Wound
   - ○ : Non-flammable
   - ◰ : Cement
   - Ⓣ : Thermistor
   - ⊗ : Fuse
   - ⊠ : Metal Oxide
   - ◎ : Metal Film
   - Ⓛ : Leadless Type
2. CAPACITOR
   All capacitors are ceramic 50V capacitor, unless otherwise noted with the following marks.
   Unit of capacitance is μF, unless otherwise noted.
   - ⊣⊢ : Electrolytic
   - (NP) : Bipolar
   - (Z) : Z Type
   - (T) : Tantalum
   - (NH) : NH Type
   - ◎ : Titanium Oxide
   - ⊗ : Temp Compensation
   - (M) : Polyester
   - Ⓢ : Polystyrene
   - ⊠ : Polypropylene
   - (m) : Metalized Polyester
3. COIL
   Unit of inductance is μH.
4. TEST POINT
   ▽ : Test point position.
5. VOLTAGE MEASUREMENT
   Voltage is measured by a volt ohm meter with DC 20k OHM/V receiving a white pattern when Brightness control is set to the maximum position.
6. When arrow mark ( ⟶ ) is found, connection is easily found along with the direction of an arrow.
7. When schematic diagram of a board is described in more than two places, they are encircled with dotted line. ( — · — · — )
8. This schematic diagram is the latest at the time of printing and subject to change without notice.





N2 TNP16934ZA

E TNP66229ZA

U TNP62437AB

C TNP52967ZA

N1 TNP62276AA

S TNP42139ZA

B TNP52598ZA

A TNP65858AB

DEAD CIRCUIT

LIVE CIRCUIT

DEGAUSSING COIL

POWER SUPPLY CIRCUIT

PANABRITE

BRIGHT

COLORPILOT SW

TINT

COLOR

SUB COLOR

ABL

B.P.B

COLOR CONT

TINT CONT

VIDEO PEAK

PED.CLAMP

BURST GATE

KILLER DET

APC DET

V.C.O

DEMOD

MATRIX B-Y

MATRIX R-Y

VIDEO CHROMA

BLUE CUT OFF

RED CUT OFF

B.DRIVE

R.DRIVE

B-OUT

R-OUT

G-OUT

SUB CONTRAST

SERVICE SW

NORMAL

SERVICE

DELAY LINE

FLESH TONE DETECTOR

BURST B.L.K

CHROMA AMP

3.58 OSC

I DET

A.I.C CHROMA AMP

FLESH TONE CORRECTION

VHF

UHF

U/V TUNER

IF AGC

VIF AGC

RF AGC

VIDEO AMP

NOISE CAN

CARRIER AMP

AFT

PICK UP ADJ

AUDIO AMP

DET

SIF

SIF AUDIO

AUDIO CONTROL

AUDIO OUT

DEFLECTION

V-HOLD

V-OUT

V.SIZE

H-OUT

H-DRIVE

H-HOLD

H.CENTER ADJ

V.CENTER ADJ

SYNC SEP

NOISE CAN

V.OSC

V.DRIVE

H-OSC

V-OSC

X-RAY PROT

M.MFC

SCREEN

FOCUS VR

CRT A18JHC30X

DY L501 TLY15233F

H.COIL

V.COIL

FBT T502 TLF14619F1

POWER SW

SW801

POWER SOCKET

CONVERTER TRANS

DRIVE TRANS

SOUNDWAVE OSC. AMP.

SAWTOOTH OSC.

ERROR DETECTOR

+12V ADDP ADJ

+24V ADDP ADJ

+8 ADJ

AFT SW

SERVICE

0.03Vp-p [H]

0.6Vp-p [H]

1.3Vp-p [H]

7.6Vp-p [H]

4.5Vp-p [H]

4.6Vp-p [H]

5.6Vp-p [H]

16Vp-p [V]

12Vp-p [H]

1.5Vp-p [H]

0.9Vp-p [V]

0.66Vp-p [V]

0.5Vp-p [H]

2.2Vp-p [H]

0.8Vp-p [H]

7.5Vp-p [H]

880Vp-p [H]

2.8Vp-p [H]

3.8Vp-p [H]

1.2Vp-p [H]

9.5Vp-p [H]

1.1Vp-p [H]

1.9Vp-p [H]

3.4Vp-p [H]

To CRT EARTH

To MAIN HEAT SINK

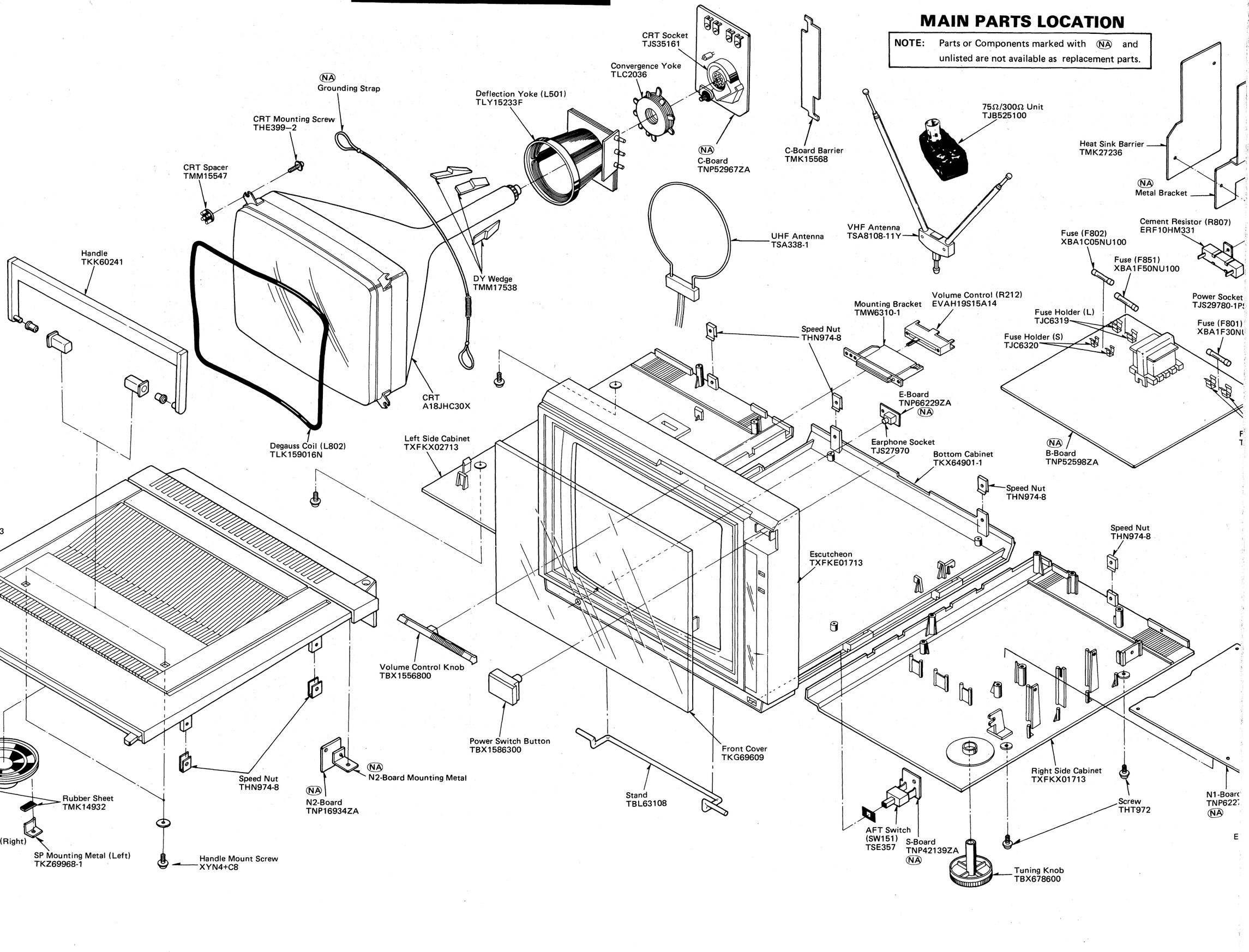
To DD04

To A35

To DD03

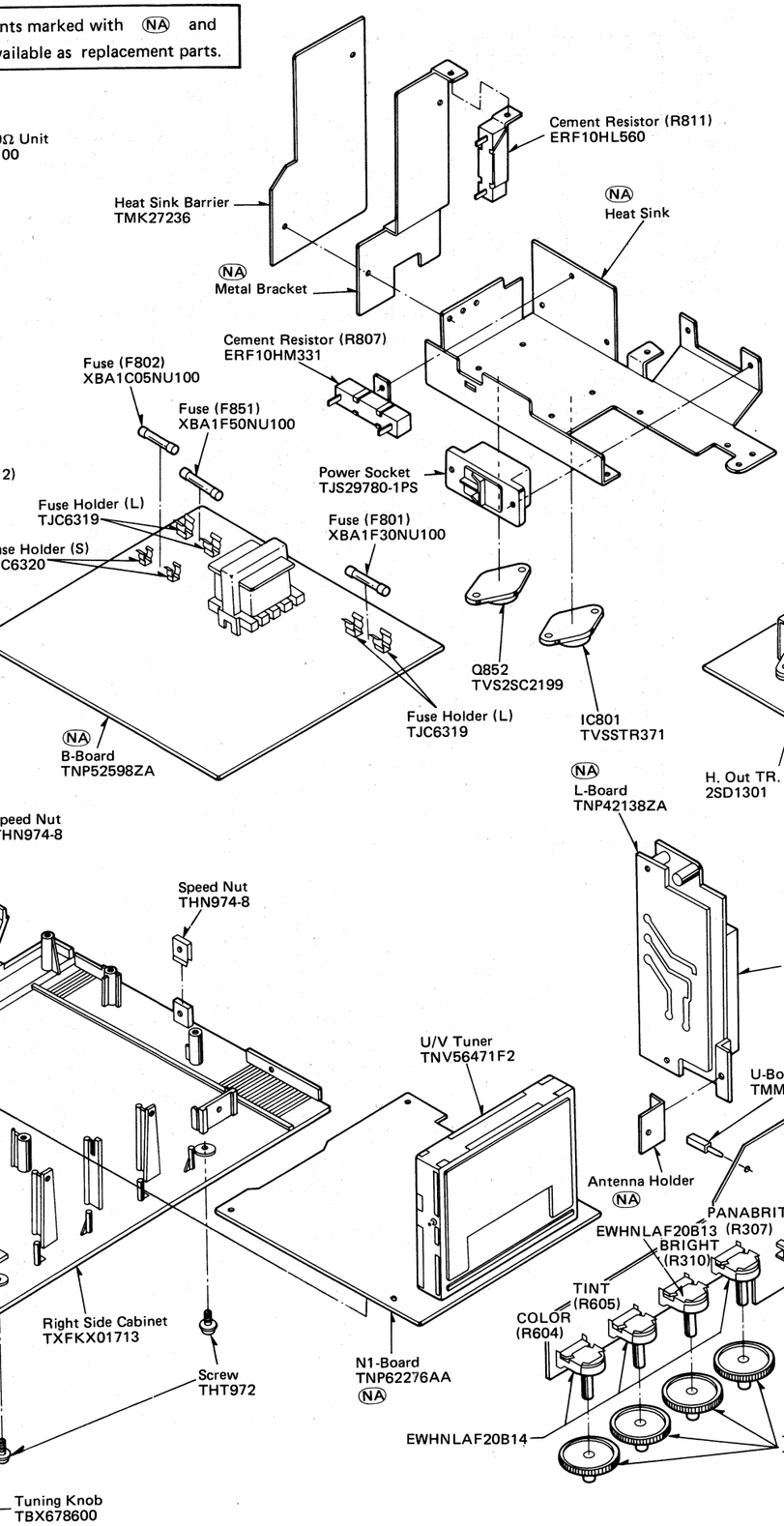
# MAIN PARTS LOCATION

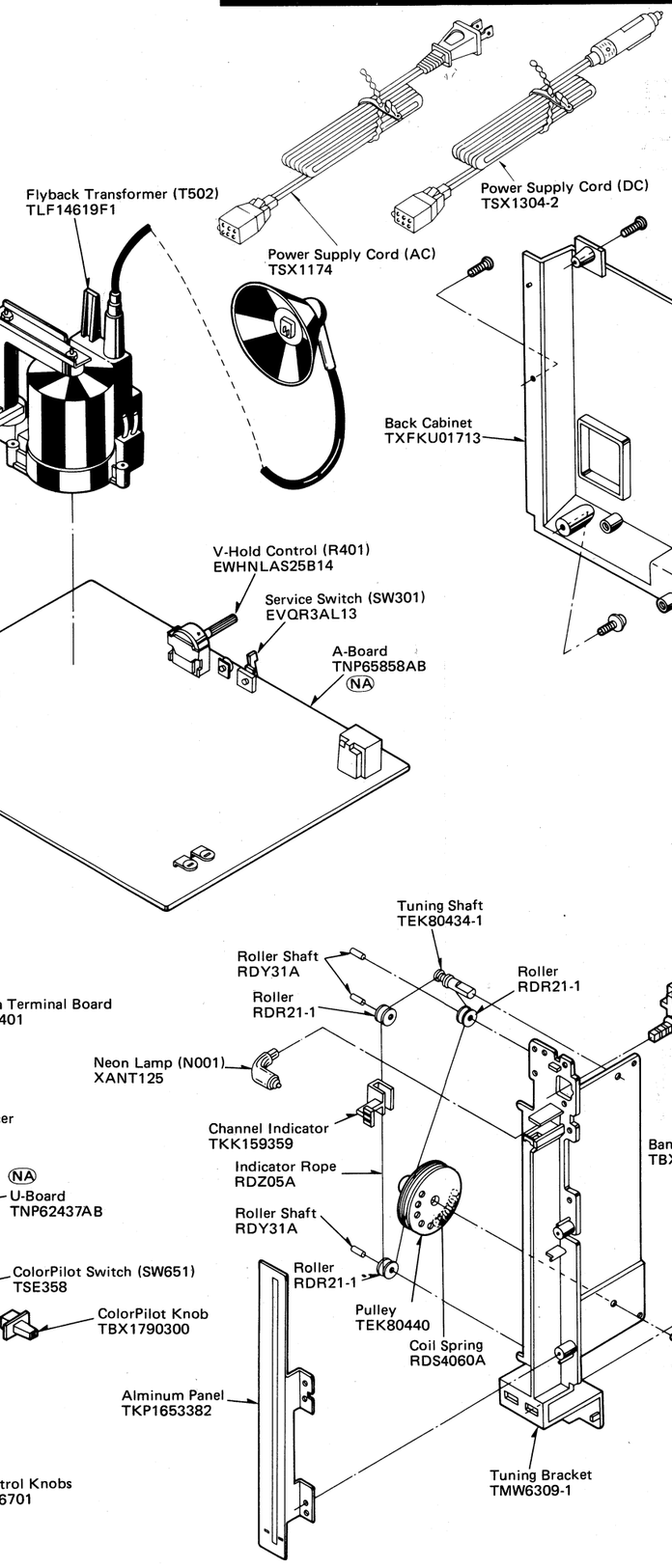
**NOTE:** Parts or Components marked with (NA) and unlisted are not available as replacement parts.

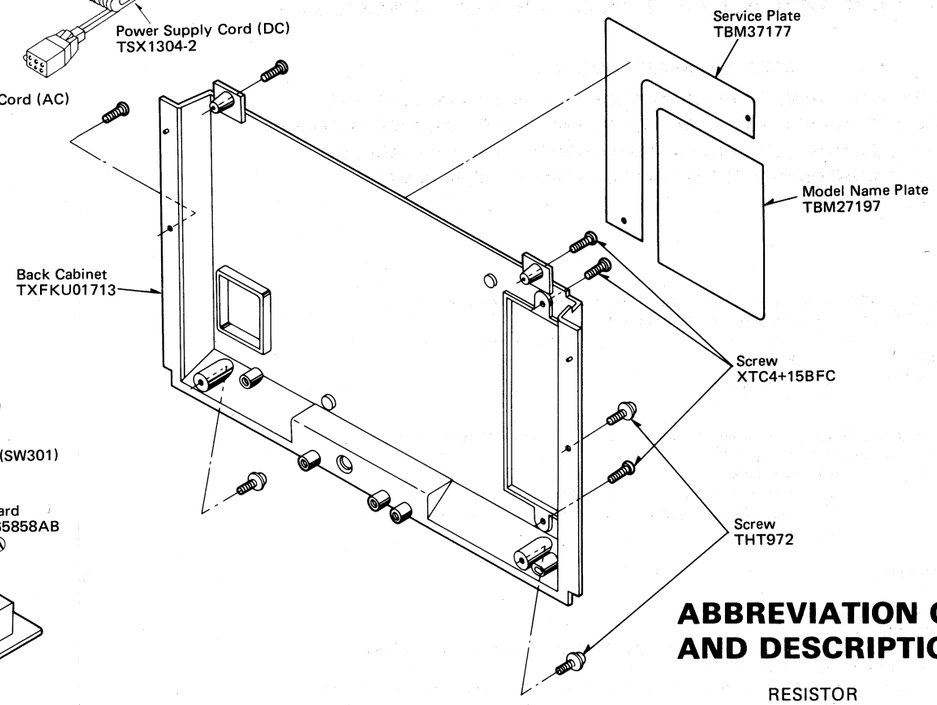


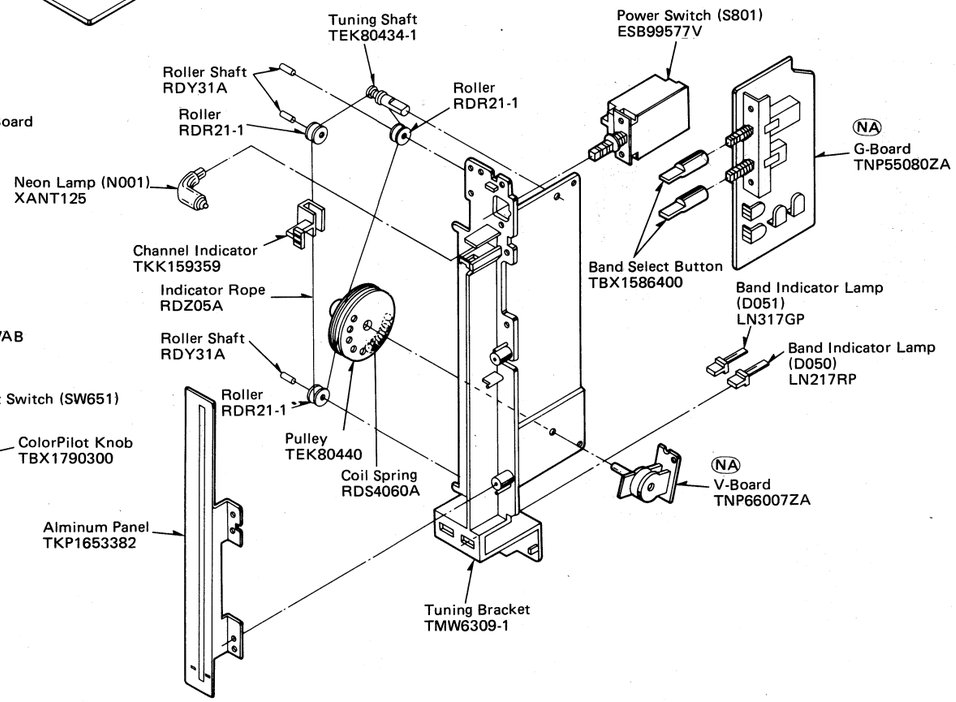
## TS LOCATION

nts marked with (NA) and
vailable as replacement parts.




## ABBREVIATION OF PART NAME AND DESCRIPTION

RESISTOR

| PART NAME & DESCRIPTION | | | |
|---|---|---|---|
| TYPE | | ALLOWANCE | |
| C | Carbon | F | ± 1% |
| F | Fuse | J | ± 5% |
| M | Metal Oxide | K | ± 10% |
| S | Solid | M | ± 20% |
| W | Wire Wound | G | ± 2% |

Part No. Description

Example: ERD25TJ104 (C) 100K (J) 1/4W

CAPACITOR

| PART NAME & DESCRIPTION | | | |
|---|---|---|---|
| TYPE | | ALLOWANCE | |
| C | Ceramic | C | ± 0.25pF |
| E | Electrolytic | D | ± 0.5pF |
| P | Polyester | F | ± 1pF |
| S | Styrol | J | ± 5% |
| T | Tantalum | K | ± 10% |
| | | L | ± 15% |
| | | M | ± 20% |
| | | P | +100% –0% |
| | | Z | +80% –20% |

Part No. Description

Example: ECKF1H103ZF (C) 0.01μF (Z) 50V

# REPLACEMENT PARTS LIST

**Important Safety Notice**

Components identified by shaded area have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

**Note:** TNP65858AB (A-Board), TNP52598ZA (B-Board), TNP52967ZA (C-Board), TNP66229ZA (E-Board), TNP55080ZA (G-Board), TNP42138ZA (L-Board), TNP62276AA (N1-Board), TNP16934ZA (N2-Board), TNP42139ZA (S-Board), TNP62437AB (U-Board), and TNP66007ZA (V-Board) are not available as a complete printed circuit board.

**RESISTORS**

| Ref. No. | Part No. | Description |
|---|---|---|
| R002 | ERD25TJ100 | C 10ohm J 1/4W |
| R003 | ERD25TJ152 | C 1.5Kohm J 1/4W |
| R004 | EWH3AH003B15 | Control B100Kohm |
| R005 | EVND4AA00B24 | Control B 20Kohm |
| R006 | EVND4AA00B34 | Control B 30Kohm |
| R007 | EVND4AA00B24 | Control B 20Kohm |
| R008 | EVND4AA00B25 | Control B200Kohm |
| R009 | EVND4AA00B53 | Control B 5Kohm |
| R010 | EVND4AA00B24 | Control B 20Kohm |
| R012 | ERD25TJ152 | C 1.5Kohm J 1/4W |
| R013 | ERD25TJ120 | C 12ohm J 1/4W |
| R021 | ERD25TJ561 | C 560ohm J 1/4W |
| R022 | ERD25TJ392 | C 3.9Kohm J 1/4W |
| R023 | ERD2CJ120 | F 12ohm J 2W |
| R024 | ERD50FJ1R0 | C 1ohm J 1/2W |
| R025 | ERD25FJ2R2 | C 2.2ohm J 1/4W |
| R026 | ERD25TJ100 | C 10ohm J 1/4W |
| R031 | ERDS2TJ104 | C 100Kohm J 1/4W |
| R032 | ERD25TJ103 | C 10Kohm J 1/4W |
| R101 | ERD25TJ123 | C 12Kohm J 1/4W |
| R102 | ERD25TJ562 | C 5.6Kohm J 1/4W |
| R103 | ERD25TJ681 | C 680ohm J 1/4W |
| R104 | ERD25TJ224 | C 220Kohm J 1/4W |
| R105 | ERD25TJ102 | C 1Kohm J 1/4W |
| R106 | ERD25TJ392 | C 3.9Kohm J 1/4W |
| R107 | EVN50AA00B23 | Control B 2Kohm |
| R108 | ERD25TJ392 | C 3.9Kohm, J 1/4W |
| R109 | ERD25TJ562 | C 5.6Kohm J 1/4W |
| R110 | ERD25TJ104 | C 100Kohm J 1/4W |
| R111 | ERD25TJ223 | C 22Kohm J 1/4W |
| R112 | ERD25TJ682 | C 6.8Kohm J 1/4W |
| R113 | ERD25TJ183 | C 18Kohm J 1/4W |
| R114 | ERD25TJ102 | C 1Kohm J 1/4W |
| R115 | ERD25TJ821 | C 820ohm J 1/4W |
| R116 | ERD25TJ271 | C 270ohm J 1/4W |
| R117 | ERD25TJ562 | C 5.6Kohm J 1/4W |
| R118 | ERD25FJ4R7P | C 4.7ohm J 1/4W |
| R119 | ERD25TJ151 | C 150ohm J 1/4W |
| R151 | ERD25TJ123 | C 12Kohm J 1/4W |
| R152 | ERD25TJ153 | C 15Kohm J 1/4W |
| R153 | ERD25TJ101 | C 100ohm J 1/4W |
| R203 | ERD25FJ330P | C 33ohm J 1/4W |
| R204 | ERD25TJ104 | C 100Kohm J 1/4W |
| R205 | ERD25TJ473 | C 47Kohm J 1/4W |
| R206 | ERD25TJ391 | C 390ohm J 1/4W |
| R207 | ERD25TJ391 | C 390ohm J 1/4W |
| R209 | ERD25TJ153 | C 15Kohm J 1/4W |
| R210 | ERD25TJ222 | C 2.2Kohm J 1/4W |
| R211 | ERD25TJ331 | C 330ohm J 1/4W |
| R212 | EVAH19S15A14 | Control A 10Kohm |
| R221 | ERD25TJ682 | C 6.8Kohm J 1/4W |
| R222 | ERD25TJ103 | C 10Kohm J 1/4W |
| R223 | ERD25TJ223 | C 22Kohm J 1/4W |
| R225 | ERD25TJ103 | C 10Kohm J 1/4W |
| R226 | ERD25TJ472 | C 4.7Kohm J 1/4W |
| R227 | ERD25TJ331 | C 330ohm J 1/4W |
| R228 | ERD25TJ271 | C 270ohm J 1/4W |
| R230 | ERD25TJ331 | C 330ohm J 1/4W |
| R231 | ERD25TJ332 | C 3.3Kohm J 1/4W |
| R251 | ERD25TJ821 | C 820ohm J 1/4W |
| R252 | ERD25TJ391 | C 390ohm J 1/4W |
| R253 | ERD25TJ222 | C 2.2Kohm J 1/4W |
| R254 | ERD50TJ331 | C 330ohm J 1/2W |
| R255 | ERD25TJ563 | C 56Kohm J 1/4W |
| R256 | ERD25TJ101 | C 100ohm J 1/4W |
| R257 | ERD12AJ270F | F 27ohm J 1/2W |
| R258 | ERD25TJ3R3 | C 3.3ohm J 1/4W |
| R259 | ERD25TJ101 | C 100ohm J 1/4W |
| R260 | ERD25TJ102 | C 1Kohm J 1/4W |
| R302 | EVN61AA00B13 | Control B 1Kohm |
| R307 | EWHNLAF20B14 | Control B 10Kohm |
| R308 | ERD25TJ332 | C 3.3Kohm J 1/4W |
| R309 | ERD25TJ332 | C 3.3Kohm J 1/4W |
| R310 | EWHNLAF20B13 | Control B 1Kohm |
| R311 | ERD25TJ682 | C 6.8Kohm J 1/4W |
| R312 | EVN61AA00B53 | Control B 5Kohm |
| R313 | ERD25TJ392 | C 3.9Kohm J 1/4W |
| R314 | ERD25TJ183 | C 18Kohm J 1/4W |
| R315 | ERD25TJ472 | C 4.7Kohm J 1/4W |
| R316 | ERD25TJ391 | C 390ohm J 1/4W |
| R317 | ERD25TJ391 | C 390ohm J 1/4W |
| R318 | ERD25TJ391 | C 390ohm J 1/4W |
| R319 | ERD25TJ681 | C 680ohm J 1/4W |
| R320 | ERD25TJ682 | C 6.8Kohm J 1/4W |
| R322 | ERD25TJ101 | C 100ohm J 1/4W |
| R324 | ERD25TJ821 | C 820ohm J 1/4W |
| R325 | ERD25TJ101 | C 100ohm J 1/4W |
| R327 | ERD25TJ221 | C 220ohm J 1/4W |

| Ref. No. | Part No. | Description |
|---|---|---|
| R331 | ERD25TJ221 | C 220ohm J 1/4W |
| R332 | ERD25TJ221 | C 220ohm J 1/4W |
| R333 | ERD25TJ682 | C 6.8Kohm J 1/4W |
| R334 | ERD25TJ103 | C 10Kohm J 1/4W |
| R335 | ERD25TJ331 | C 330ohm J 1/4W |
| R336 | ERD25TJ151 | C 150ohm J 1/4W |
| R337 | ERD25TJ151 | C 150ohm J 1/4W |
| R338 | ERD25TJ561 | C 560ohm J 1/4W |
| R339 | ERD25TJ331 | C 330ohm J 1/4W |
| R340 | ERD25TJ391 | C 390ohm J 1/4W |
| R341 | ERD25TJ102 | C 1Kohm J 1/4W |
| R342 | ERD25TJ123 | C 12Kohm J 1/4W |
| R343 | ERD25TJ472 | C 4.7Kohm J 1/4W |
| R344 | ERD25TJ153 | C 15Kohm J 1/4W |
| R345 | ERD25TJ221 | C 220ohm J 1/4W |
| R346 | ERD25TJ151 | C 150ohm J 1/4W |
| R347 | ERD25TJ151 | C 150ohm J 1/4W |
| R348 | ERD25TJ821 | C 820ohm J 1/4W |
| R351 | EVN61AA00B14 | Control B 10Kohm |
| R352 | ERD25TJ562 | C 5.6Kohm J 1/4W |
| R353 | EVN61AA00B33 | Control B 3Kohm |
| R354 | ERG1SJ223P | M 22Kohm J 1W |
| R355 | ERC14GK272 | S 2.7Kohm M 1/4W |
| R356 | EVN61AA00B14 | Control B 10Kohm |
| R357 | ERD25TJ562 | C 5.6Kohm J 1/4W |
| R358 | EVN61AA00B33 | Control B 3Kohm |
| R359 | ERG1SJ223P | M 22Kohm J 1W |
| R360 | ERC14GK272 | S 2.7Kohm M 1/4W |
| R363 | ERD25TJ123 | C 12Kohm J 1/4W |
| R364 | ERD25TJ152 | C 1.5Kohm J 1/4W |
| R365 | ERG1SJ223P | M 22Kohm J 1W |
| R366 | ERC14GK272 | S 2.7Kohm M 1/4W |
| R367 | ERC12GM105 | S 1Mohm M 1/2W |
| R368 | EVME6U10KB17 | Control B 10Mohm |
| R371 | ERD25TJ472 | C 4.7Kohm J 1/4W |
| R372 | ERD25TJ151 | C 150ohm J 1/4W |
| R375 | ERD25TJ820 | C 82ohm J 1/4W |
| R376 | ERD25TJ221 | C 220ohm J 1/4W |
| R377 | ERD25TJ153 | C 15Kohm J 1/4W |
| R378 | ERD25TJ822 | C 8.2Kohm J 1/4W |
| R379 | ERD25TJ101 | C 100ohm J 1/4W |
| R380 | ERD25TJ153 | C 15Kohm J 1/4W |
| R381 | ERD25TJ822 | C 8.2Kohm J 1/4W |
| R382 | ERD25TJ750 | C 75ohm J 1/4W |
| R391 | ERD25TJ103 | C 10Kohm J 1/4W |

| Ref. No. | Part No. | Description |
|---|---|---|
| R392 | ERD25TJ102 | C 1Kohm J 1/4W |
| R393 | ERD25TJ102 | C 1Kohm J 1/4W |
| R401 | EWHNLA625B14 | Control B 10Kohm |
| R402 | ERD25TJ103 | C 10Kohm J 1/4W |
| R403 | ERD25TJ682 | C 6.8Kohm J 1/4W |
| R404 | ERD25TJ152 | C 1.5Kohm J 1/4W |
| R405 | ERD50TJ102 | C 1Kohm J 1/2W |
| R406 | ERD25FJ101 | C 100ohm J 1/4W |
| R407 | ERD50FJ5R6P | C 5.6ohm J 1/2W |
| R408 | ERD25TJ472 | C 4.7Kohm J 1/4W |
| R409 | EVTKOCA00B52 | Control B 500ohm |
| R410 | ERD25TJ391 | C 390ohm J 1/4W |
| R411 | ERD50FJ3R3 | C 3.3ohm J 1/2W |
| R412 | ERD25FJ560 | C 56ohm J 1/4W |
| R413 | ERD25TJ221 | C 220ohm J 1/4W |
| R414 | ERD25TJ151 | C 150ohm J 1/4W |
| R417 | ERD25FJ121 | C 120ohm J 1/4W |
| R501 | ERD25TJ331 | C 330ohm J 1/4W |
| R502 | ERD25TJ332 | C 3.3Kohm J 1/4W |
| R503 | ERD25TJ103 | C 10Kohm J 1/4W |
| R505 | ERD25TJ222 | C 2.2Kohm J 1/4W |
| R506 | EVTKOCA00B23 | Control B 2Kohm |
| R507 | ERD25TJ393 | C 39Kohm J 1/4W |
| R508 | ERG2ANJ103 | M 10Kohm J 2W |
| R509 | ERD25TJ561 | C 560ohm J 1/4W |
| R510 | ERD25TJ681 | C 680ohm J 1/4W |
| R511 | ERG1ANJ562H | M 5.6Kohm J 1W |
| R512 | ERG2ANJ222 | M 2.2Kohm J 2W |
| R513 | ERQ12HKR39 | F 0.39ohm K 1/2W |
| R514 | ERQ2CJ1R8 | F 1.8ohm J 2W |
| R516 | ERD25TJ223 | C 22Kohm J 1/4W |
| R517 | ERG1ANJ330H | M 33ohm J 1W |
| R518 | ERD25TJ393 | C 39Kohm J 1/4W |
| R519 | ERD25FJ561 | C 560ohm J 1/4W |
| R520 | ERD25TJ564 | C 560Kohm J 1/4W |
| R521 | ERD25TJ391 | C 390ohm J 1/4W |
| R522 | ERD25TJ221 | C 220ohm J 1/4W |
| R523 | ERD25TJ101 | C 100ohm J 1/4W |
| R524 | ERD25TJ393 | C 39Kohm J 1/4W |
| R525 | ERG1ANJ333 | M 33Kohm J 1W |
| R526 | ERD25TJ681 | C 680ohm J 1/4W |
| R529 | ERD25FJ271 | C 270ohm J 1/4W |
| R530 | ERQ12AJ271P | F 270ohm J 1/2W |
| R531 | ERD25TJ102 | C 1Kohm J 1/4W |
| R532 | ERD25TJ273 | C 27Kohm J 1/4W |

| Ref. No. | Part No. | Description |
|---|---|---|
| R533 | ERD25FJ101 | C 100ohm J 1/4W |
| R601 | ERD25TJ102 | C 1Kohm J 1/4W |
| R602 | ERD25TJ102 | C 1Kohm J 1/4W |
| R604 | EWHNLAF20B14 | Control B 10Kohm |
| R605 | EWHNLAF20B14 | Control B 10Kohm |
| R606 | ERD25TJ394 | C 390Kohm J 1/4W |
| R607 | ERD25TJ102 | C 1Kohm J 1/4W |
| R651 | ERD25TJ102 | C 1Kohm J 1/4W |
| R652 | ERD25TJ472 | C 4.7Kohm J 1/4W |
| R653 | ERD25TJ822 | C 8.2Kohm J 1/4W |
| R654 | ERD25TJ183 | C 18Kohm J 1/4W |
| R655 | ERD25TJ153 | C 15Kohm J 1/4W |
| R656 | ERD25TJ392 | C 3.9Kohm J 1/4W |
| R657 | ERD25TJ273 | C 27Kohm J 1/4W |
| R658 | EVN61AA00B15 | Control B100Kohm |
| R659 | ERD25TJ224 | C 220Kohm J 1/4W |
| R660 | ERD25TJ473 | C 47Kohm J 1/4W |
| R661 | ERD25TJ563 | C 56Kohm J 1/4W |
| R801 | ERF3AK1R0 | W 1ohm K 3W |
| R804 | ERD25TLJ103 | C 10Kohm J 1/4W |
| R805 | ERD25FJ470P | C 47ohm J 1/4W |
| R806 | ERD25TLJ224 | C 220Kohm J 1/4W |
| R807 | ERF10HM331 | W 330ohm J 10W |
| R808 | ERD25FJ560P | C 56ohm J 1/4W |
| R809 | ERDS1TJ124 | C 120Kohm J 1/2W |
| R810 | ERC12ZGK105 | S 1Mohm K 1/2W |
| R811 | ERF10HL560 | W 56ohm J 10W |
| R851 | ERD25TLJ104 | C 100Kohm J 1/4W |
| R852 | ERD25TLJ104 | C 100Kohm J 1/4W |
| R853 | ERD25TLJ104 | C 100Kohm J 1/4W |
| R854 | ERD25TLJ473 | C 47Kohm J 1/4W |
| R855 | ERD25TLJ183 | C 18Kohm J 1/4W |
| R856 | ERD25TLJ472 | C 4.7Kohm J 1/4W |
| R857 | ERD25TLJ123 | C 12Kohm J 1/4W |
| R858 | ERD25TLJ183 | C 18Kohm J 1/4W |
| R859 | ERD25TLJ123 | C 12Kohm J 1/4W |
| R860 | ERD25TLJ152 | C 1.5Kohm J 1/4W |
| R861 | ERG2ANJ470H | M 47ohm J 2W |
| R864 | ERDS1TJ104 | C 100Kohm J 1/2W |
| R865 | ERD25TLJ182 | C 1.8Kohm J 1/4W |
| R866 | ERD25FJ392 | C 3.9Kohm J 1/4W |
| R867 | EVND4AA00B23 | Control B 2Kohm |
| R868 | ERD25TLJ103 | C 10Kohm J 1/4W |
| R869 | ERD25TLJ221 | C 220ohm J 1/4W |
| R870 | ERD25TLJ183 | C 18Kohm J 1/4W |
| R871 | ERD25TLJ105 | C 1Mohm J 1/4W |
| R872 | ERD25TLJ472 | C 4.7Kohm J 1/4W |
| R873 | ERDS1TJ562 | C 5.6Kohm J 1/2W |
| R874 | EVND4AA00B52 | Control B 500ohm |
| R875 | ERD25TLJ821 | C 820ohm J 1/4W |
| R876 | ERD25TLJ333 | C 33Kohm J 1/4W |
| R877 | ERD25TLJ472 | C 4.7Kohm J 1/4W |
| R878 | ERD25TLJ222 | C 2.2Kohm J 1/4W |
| R879 | ERD25TLJ103 | C 10Kohm J 1/4W |
| R880 | ERD25TLJ562 | C 5.6Kohm J 1/4W |
| R881 | ERD25TLJ392 | C 3.9Kohm J 1/4W |
| R882 | ERD25TLJ183 | C 18Kohm J 1/4W |
| R883 | ERDS1TJ222 | C 2.2Kohm J 1/2W |
| R884 | ERD25TLJ330 | C 33ohm J 1/4W |
| R885 | ERD25TLJ272 | C 2.7Kohm J 1/4W |
| R886 | ERD25TLJ561 | C 560ohm J 1/4W |
| R887 | EVND4AA00B52 | Control B 500ohm |
| R888 | ERDS1TJ124 | C 120Kohm J 1/2W |
| R889 | ERD25TLJ183 | C 18Kohm J 1/4W |
| R890 | ERDS1TJ101 | C 100ohm J 1/2W |
| R891 | ERD25FJ331 | C 330ohm J 1/4W |
| R892 | ERDS2TJ472 | C 4.7Kohm J 1/4W |

## CAPACITORS

| | | | | |
|---|---|---|---|---|
| C001 | ECEA16Z100 | E | 100uF | 16V |
| C002 | ECEA1CU101 | E | 100uF | 16V |
| C003 | ECKF1H103ZF | C | 0.01uF Z | 50V |
| C004 | ECEA50ZR22 | E | 0.22uF | 50V |
| C005 | ECEA1CU330 | E | 33uF | 16V |
| C020 | ECEA1JU330 | E | 33uF | 63V |
| C021 | ECEA25Z33 | E | 33uF | 25V |
| C022 | ECKD2H682MD | C | 6800pF M | 500V |
| C023 | ECKD2H272KB2 | C | 2700pF K | 500V |
| C024 | ECKF1H103ZF | C | 0.01uF Z | 50V |
| C025 | ECEA1CU471 | E | 470uF | 16V |
| C026 | ECKD2H682MD | C | 6800pF M | 500V |
| C101 | ECCF1H101J | C | 100pF J | 50V |
| C102 | ECCF1H120JC | C | 12pF J | 50V |
| C103 | ECKF1H102KB | C | 1000pF K | 50V |
| C104 | ECCF1H390J | C | 39pF J | 50V |
| C105 | ECKF1H103ZF | C | 0.01uF Z | 50V |
| C106 | ECKF1H223ZF | C | 0.022uF Z | 50V |
| C107 | ECKF1H103ZF | C | 0.01uF Z | 50V |
| C108 | ECEA50Z1 | E | 1uF | 50V |

# CTG-713

| Ref. No. | Part No. | Description | | | | Ref. No. | Part No. | Description | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| C109 | ECEA1HUR47 | E | 0.47uF | | 50V | C304 | ECCF1H820J | C | 82pF | J | 50V |
| C110 | ECKF1H103ZF | C | 0.01uF | Z | 50V | C305 | ECEA1CU100 | E | 10uF | | 16V |
| C111 | ECCF1H820JP | C | 82pF | J | 50V | C306 | ECEA1EU4R7 | E | 4.7uF | | 25V |
| C113 | ECEA1CU101 | E | 100uF | | 16V | C307 | ECQM1H103KV | P | 0.01uF | K | 50V |
| C114 | ECKF1H103ZF | C | 0.01uF | Z | 50V | C308 | ECEA1HU3R3 | E | 3.3uF | | 50V |
| C116 | ECKF1H103ZF | C | 0.01uF | Z | 50V | C309 | ECKF1H223ZF | C | 0.022uF | Z | 50V |
| C117 | ECEA50Z2R2 | E | 2.2uF | | 50V | C310 | ECCF1H101J | C | 100pF | J | 50V |
| C118 | ECKF1H103ZF | C | 0.01uF | Z | 50V | C331 | ECEA1CU100 | E | 10uF | | 16V |
| C119 | ECEA16Z100 | E | 100uF | | 16V | C332 | ECEA1CU100 | E | 10uF | | 16V |
| C120 | ECKF1H103ZF | C | 0.01uF | Z | 50V | C333 | ECEA1HU2R2 | E | 2.2uF | | 50V |
| C121 | ECKF1H103ZF | C | 0.01uF | Z | 50V | C334 | ECEA1CU100 | E | 10uF | | 16V |
| C123 | ECEA50ZR22 | E | 0.22uF | | 50V | C335 | ECKF1H681KB | C | 680pF | K | 50V |
| C124 | ECCF1H120JC | C | 12pF | J | 50V | C351 | ECKF1H221KB | C | 220pF | K | 50V |
| C125 | ECCF1H03ODC | C | 3pF | D | 50V | C352 | ECKF1H221KB | C | 220pF | K | 50V |
| C126 | ECKF1H103ZF | C | 0.01uF | Z | 50V | C353 | ECKF1H181KB | C | 180pF | K | 50V |
| C151 | ECCF1H080CC | C | 8pF | C | 50V | C355 | ECKD3A102KBN | C | 1000pF | K | 1KV |
| C152 | ECCF1H560JC | C | 56pF | J | 50V | C356 | ECKF1H103ZF | C | 0.01uF | Z | 50V |
| C153 | ECKF1H223ZF | C | 0.022uF | Z | 50V | C372 | ECEA0JN470S | E | 47uF | | 6.3V |
| C154 | ECEA1HU010 | E | 1uF | | 50V | C373 | ECEA0JU102 | E | 1000uF | | 6.3V |
| C155 | ECEA1HU3R3 | E | 3.3uF | | 50V | C374 | ECEA1CU100 | E | 10uF | | 16V |
| C201 | ECQM1H473KV | P | 0.047uF | K | 50V | C401 | ECQM1H273KV | P | 0.027uF | K | 50V |
| C202 | ECEA1CU471 | E | 470uF | | 16V | C402 | ECSZ25EF2R2N | T | 2.2uF | | 25V |
| C203 | ECQM1H822KV | P | 8200pF | K | 50V | C403 | ECSZ16EF3R3V | T | 3.3uF | | 16V |
| C204 | ECEA1CU100 | E | 10uF | | 16V | C404 | ECEA25Z22 | E | 22uF | | 25V |
| C205 | ECEA1CU100 | E | 10uF | | 16V | C405 | ECEA1EU221 | E | 220uF | | 25V |
| C206 | ECCF1H820JL | C | 82pF | J | 50V | C406 | ECEA25Z4R7 | E | 4.7uF | | 25V |
| C207 | ECCF1H120JP | C | 12pF | J | 50V | C408 | ECEA1CU101 | E | 100uF | | 16V |
| C208 | ECQM1H183KV | P | 0.018uF | K | 50V | C409 | ECEA1CU222 | E | 2200uF | | 16V |
| C209 | ECQM1H123KV | P | 0.012uF | K | 50V | C410 | ECKF1H223ZF | C | 0.022uF | Z | 50V |
| C210 | ECEA1CU101 | E | 100uF | | 16V | C412 | ECEA50Z4R7 | E | 4.7uF | | 50V |
| C211 | ECCF1H470J | C | 47pF | J | 50V | C413 | ECKF1H221KB | C | 220pF | K | 50V |
| C212 | ECCF1H080CC | C | 8pF | C | 50V | C414 | ECKF1H472KB | C | 4700pF | K | 50V |
| C222 | ECEA1CU100 | E | 10uF | | 16V | C501 | ECEA1HU2R2 | E | 2.2uF | | 50V |
| C223 | ECEA1CU100 | E | 10uF | | 16V | C502 | ECEA1CU100 | E | 10uF | | 16V |
| C226 | ECEA1CU470 | E | 47uF | | 16V | C503 | ECEA1HU2R2 | E | 2.2uF | | 50V |
| C251 | ECEA1HU4R7 | E | 4.7uF | | 50V | C504 | ECQM1H153KV | P | 0.015uF | K | 50V |
| C252 | ECEA1CU331 | E | 330uF | | 16V | C505 | ECQK1472JZ | P | 4700pF | J | 100V |
| C253 | ECEA1CU471 | E | 470uF | | 16V | C506 | ECEA1CU101 | E | 100uF | | 16V |
| C254 | ECQM1H103KV | P | 0.01uF | K | 50V | C507 | ECQM1H104KV | P | 0.1uF | K | 50V |
| C255 | ECKF1H102KB | C | 1000pF | K | 50V | C508 | ECQM1H473KV | P | 0.047uF | K | 50V |
| C256 | ECQM1H273KV | P | 0.027uF | K | 50V | C509 | ECEA160V33W | E | 33uF | | 160V |
| C257 | ECKF1H152KB | C | 1500pF | K | 50V | C510 | ECKD2H332KB2 | C | 3300pF | K | 500V |
| C258 | ECEA1HNR47S | E | 0.47uF | | 50V | C511 | ECKD3D561KBN | C | 560pF | K | 2KV |
| C301 | ECCF1H101J | C | 100pF | J | 50V | C512 | ECQF2H274JZA | P | 0.27uF | J | 200V |
| C303 | ECEA1CN100S | E | 10uF | | 16V | C513 | ECEA1EU471 | E | 470uF | | 25V |

| Ref. No. | Part No. | Description |
|---|---|---|
| C514 | ECEA1HU100 | E 10uF 50V |
| C515 | ECEA0JU330 | E 33uF 6.3V |
| C516 | ECQM1H222KV | P 2200pF K 50V |
| C517 | ECKF1H102KB | C 1000pF K 50V |
| C518 | ECKD3D561KBN | C 560pF K 2KV |
| C519 | ECKF1H682KB | C 6800pF K 50V |
| C520 | ECKD2H102KB2 | C 1000pF K 500V |
| C521 | ECEA2CS010 | E 1uF 160V |
| C522 | ECKD2H102KB2 | C 1000pF K 500V |
| C523 | ECKF1H331KB | C 330pF K 50V |
| C525 | ECKD3D102KBE | C 1000pF K 2KV |
| C601 | ECCF1H390J | C 39pF J 50V |
| C602 | ECKF1H103ZF | C 0.01uF Z 50V |
| C603 | ECKF1H103ZF | C 0.01uF Z 50V |
| C604 | ECEA1HU010 | E 1uF 50V |
| C605 | ECEA50ZR22 | E 0.22uF 50V |
| C606 | ECEA1EN4R7S | E 4.7uF 25V |
| C607 | ECEA50ZR22 | E 0.22uF 50V |
| C608 | ECEA50Z1 | E 1uF 50V |
| C609 | ECKF1H391KB | C 390pF K 50V |
| C610 | ECKF1H272KB | C 2700pF K 50V |
| C613 | ECCF1H220J | C 22pF J 50V |
| C614 | ECCF1H101J | C 100pF J 50V |
| C615 | ECEA1CU102 | E 1000uF 16V |
| C616 | ECCF1H470J | C 47pF J 50V |
| C651 | ECEA1HU010 | E 1uF 50V |
| C652 | ECKF1H391KB | C 390pF K 50V |
| C653 | ECCF1H270JC | C 27pF J 50V |
| C654 | ECCF1H390JC | C 39pF J 50V |
| C655 | ECV1ZW40X32 | Trimmer |
| C657 | ECCF1H330J | C 33pF J 50V |
| C658 | ECCF1H470J | C 47pF J 50V |
| C659 | ECKF1H103ZF | C 0.01uF Z 50V |
| C660 | ECCF1H470JC | C 47pF J 50V |
| C661 | ECKF1H103ZF | C 0.01uF Z 50V |
| C662 | ECKF1H103ZF | C 0.01uF Z 50V |
| C801 | ECKM2H103PU7 | C 0.01uF P 500V |
| C802 | ECKM2H103PU7 | C 0.01uF P 500V |
| C803 | ECKM2H103PU7 | C 0.01uF P 500V |
| C804 | ECKM2H103PU7 | C 0.01uF P 500V |
| C805 | ECET2DR221SL | E 220pF 200V |
| C806 | ECEA2CS220 | E 22uF 160V |
| C807 | ECKM2H103PU7 | C 0.01uF P 500V |
| C808 | ECQU1A104MH | P 0.1uF M |
| C809 | ECQU1A472MH | P 4700pF M |

| Ref. No. | Part No. | Description |
|---|---|---|
| C810 | ECKDEL471MB | C 470pF UL/CSA |
| C851 | ECKF1H391KB | C 390pF K 50V |
| C852 | ECKF1H101KB | C 100pF K 50V |
| C853 | ECKF1H101KB | C 100pF K 50V |
| C854 | ECQP1222GZ | P 2200pF G 100V |
| C855 | ECEA1CU100 | E 10uF 16V |
| C856 | ECQV1H104JZ | P 0.1uF J 50V |
| C858 | ECQM1H562KV | P 5600pF K 50V |
| C859 | ECEA1VF471R | E 470uF 35V |
| C861 | ECKD3A102KBN | C 1000pF K 1KV |
| C862 | ECEA2CS101 | E 100uF 160V |
| C863 | ECKD2H102KB2 | C 1000pF K 500V |
| C864 | ECEA1EU221 | E 220uF 25V |
| C865 | ECQV1H104JZ | P 0.1uF J 50V |
| C866 | ECKF1H103ZF | C 0.01uF Z 50V |
| C867 | ECQV1H224JZ | P 0.22uF J 50V |
| C868 | ECEA1AU221 | E 220uF 10V |
| C870 | ECEA160G3R3 | E 3.3uF 160V |
| C871 | ECKF1H181KB | C 180pF K 50V |
| C873 | ECKD3A221KBN | C 220pF K 1KV |
| C874 | ECEA1HU470 | E 47uF 50V |
| C875 | ECKF1H103ZF | C 0.01uF Z 50V |
| C877 | ECEA1VU331 | E 330uF 35V |
| C878 | ECKF1H103ZF | C 0.01uF Z 50V |
| C879 | ECEA1AN220S | E 22uF 10V |
| C880 | ECKF1H103ZF | C 0.01uF Z 50V |
| C881 | ECKD2H561KB2 | C 560pF K 500V |
| CR202 | EXPP820K333S | C-R Combination |
| CR331 | EXNG102P365D | C-R Combination |
| CR332 | EXNG471P02D | C-R Combination |
| CR501 | EXRP271K682S | C-R Combination |

## COILS

| | | |
|---|---|---|
| L101 | TLQR22N205C | Peaking 0.22uH |
| L102 | TLQR47N205C | Peaking 0.47uH |
| L103 | TLQ100K126 | Peaking 10uH |
| L251 | TLQ220K126Y | Peaking 22uH |
| L301 | TLK150834 | Degauss Coil |
| L331 | TLQ470K205C | Peaking 47uH |
| L351 | TLT221K991T | Peaking 220uH |
| L501 | TLY15233F | Deflection Yoke |
| L502 | TLP408C | Choke Coil |
| L503 | TLP408C | Choke Coil |
| L504 | TLQ390K126 | Peaking 39uH |

| Ref. No. | Part No. | Description |
|---|---|---|
| L601 | TLQ082K205C | Peaking 8.2uH |
| L602 | TLT542K993G | Peaking 5.4mH |
| L603 | TLT150K991K | Peaking 15uH |
| L651 | TLQ330K205C | Peaking 33uH |
| L652 | TLQ560K205C | Peaking 56uH |
| L653 | TLT561K991K | Peaking 560uH |
| L801 | TLP6506P | Line Filter |
| L802 | TLK159016N | Degauss Coil |
| L852 | TLT056K109 | Peaking 5.6uH |
| L853 | TLT056K109 | Peaking 5.6uH |
| L854 | TSC909 | Choke Coil |
| L855 | TSC909 | Choke Coil |
| L856 | TLT056K109 | Peaking 5.6uH |
| L857 | TSC909 | Choke Coil |
| L858 | TSC909 | Choke Coil |

## TRANSFORMERS

| | | |
|---|---|---|
| T101 | TLI81368-1 | VIF Trans. |
| T102 | TLI63307-1 | VIF Trans. |
| T103 | TLI153758 | VIF Trans. |
| T151 | TLI67394-1 | VIF Trans. |
| T201 | TLS63318-2 | SIF Trans. |
| T202 | TLS133305 | SIF Trans. |
| T351 | ETD24Z4AY | Video Trans. |
| T501 | TLH6436 | H. Drive Trans. |
| T502 | TLF14619F1 | Flyback Trans. |
| T851 | TLP15903 | Choke Coil |
| T852 | TLP15706 | Choke Coil |

## DIODES

| | | |
|---|---|---|
| D001 | TVS1S2076 | Diode |
| D002 | TVS1S2076 | Diode |
| D003 | TVSRGP10J | Diode |
| D004 | TVSRGP10J | Diode |
| D005 | TVSRD6.2FB1 | Zener Diode 6.2V |
| D006 | TVSRD6.2FB1 | Zener Diode 6.2V |
| D050 | LN217RP | LED |
| D051 | LN317GP | LED |
| D221 | TVS1S2076 | Diode |
| D222 | TVS1S2076 | Diode |
| D251 | TVS1S2076 | Diode |
| D252 | TVS1S2076 | Diode |
| D302 | TVS1S2076 | Diode |
| D331 | TVS1S2076 | Diode |
| D371 | TVS1S2076 | Diode |

| Ref. No. | Part No. | Description |
|---|---|---|
| D372 | TVS1S2076 | Diode |
| D402 | TVSRD15EB2 | Zener Diode 15V |
| D403 | TVS1S2076 | Diode |
| D404 | TVS1S2076 | Diode |
| D405 | MA27B | Diode |
| D501 | TVSRGP10J | Diode |
| D502 | TVS1S2076 | Diode |
| D503 | MA27WA | Diode |
| D504 | TVS1S2076 | Diode |
| D505 | TVSRD20EBM | Zener Diode 20V |
| D506 | TVSRD5.1EB1 | Zener Diode 5.1V |
| D507 | TVSRD12FB2 | Zener Diode 12V |
| D508 | TVS1S954 | Diode |
| D509 | TVS1S954 | Diode |
| D511 | TVSRD5.1EB1 | Zener Diode 5.1V |
| D651 | MA27T-A | Diode |
| D652 | TVS1S954 | Diode |
| D653 | TVS1S954 | Diode |
| D801 | TVSERC0508 | Diode |
| D802 | TVSERC0508 | Diode |
| D803 | TVSERC0508 | Diode |
| D804 | TVSERC0508 | Diode |
| D805 | ERPF5B0M080F | Posistor |
| D806 | TVSRGP10J | Diode |
| D851 | MA165 | Diode |
| D852 | MA27WA | Diode |
| D854 | TVSUF2B | Diode |
| D855 | TVSRD5.1EB1 | Zener Diode 5.1V |
| D856 | MA165 | Diode |
| D857 | TVSRGP10J | Diode |
| D859 | MA165 | Diode |
| D860 | MA165 | Diode |
| D861 | TVSRD18EB2 | Zener Diode 18V |
| D862 | TVSRGP10J | Diode |
| D863 | TVSRD22EB1 | Zener Diode 22V |

## TRANSISTORS

| | | |
|---|---|---|
| Q001 | 2SB642-Q,R | Switching |
| Q101 | 2SC1687 | VIF Amp |
| Q201 | 2SD636-R,S,T | Audio Amp |
| Q221 | 2SD636-R,S,T | Audio Amp |
| Q251 | 2SC1383-QNC | Audio Output |
| Q252 | 2SC1383-QNC | Audio Output |
| Q331 | 2SD636-R,S,T | Video Amp |
| Q332 | 2SD636-R,S,T | Video Amp |

| Ref. No. | Part No. | Description |
|---|---|---|
| Q333 | 2SD636-R.S.T | Video Amp |
| Q334 | 2SD636-R.S.T | Video Amp |
| Q351 | 2SC1473-QNC | Video Output(B) |
| Q352 | 2SC1473-QNC | Video Output(R) |
| Q353 | 2SC1473-QNC | Video Output(G) |
| Q371 | 2SD638-R.S.T | Video Amp |
| Q372 | 2SD638-R.S.T | Video Amp |
| Q373 | 2SD638-R.S.T | Video Amp |
| Q401 | 2SD856-Q | V. Output |
| Q402 | 2SD856-Q | V. Output |
| Q501 | 2SC1573A-R | H. Drive |
| Q502 | 2SD1301 | H. Output |
| Q503 | TVS03P2M | Thyristor |
| Q851 | 2SC1383-R.S | Comparator Amp |
| Q852 | 2SC2199 | Converter Out |
| Q853 | 2SD636-R.S.T | Comparator Amp |
| Q854 | 2SD636-R.S.T | Comparator Amp |
| | **I.C** | |
| IC001 | TVSUPC574J | Regulator |
| IC101 | AN5130 | VIF.AGC.Det.AFT |
| IC201 | AN240FN | SIF Audio |
| IC401 | AN5436N | H/V Osc. V Drive |
| IC601 | TVSCN5311 | Chroma |
| IC651 | AN5320 | ColorPilot |
| IC801 | TVSSTR371 | Regulator |
| IC851 | TVSUPC339C | Comparator |
| | **FILTERS** | |
| X101 | EFCH45MVZ2 | Filter |
| X201 | EFCS4R5M93 | Filter |
| X651 | TSS816N2 | Crystal |
| | **SWITCHES** | |
| S050 | TSE1470 | Band Select SW |
| S151 | TSE357 | AFT Switch |
| S221 | ESD32154 | Monitor/TV Switch |
| S301 | EVQR3AL13 | Service Switch |
| S651 | TSE358 | ColorPilot Switch |
| S801 | ESB99577V | Power Switch |
| | **OTHERS** | |
| | A18JHC30X | Picture Tube |
| | EAS8P510SA | Speaker |

| Ref. No. | Part No. | Description |
|---|---|---|
| | NQ27S | Insulator/IC TR |
| | RDR21-1 | Roller |
| | RDS4060A | Coil Spring |
| | RDY31A | Roller Shaft |
| | RDZ05A | Indicator Rope |
| | S-5 | Mica Sheet/Q852 |
| | TBL63108 | Stand |
| | TBL63402 | Rubber Foot |
| | TBM27197 | Model Name Plate |
| | TBM37177 | Service Plate |
| | TBX1556701 | Top Cont Knob |
| | TBX1556800 | Volume Cont Knob |
| | TBX1586300 | Power SW Button |
| | TBX1586400 | Band Selec Button |
| | TBX1790300 | ColorPilot Knob |
| | TBX678600 | Tuning Knob |
| | TEK80434-1 | Tuning Shaft |
| | TEK80440 | Pulley |
| | THE399-2 | CRT Mount Screw |
| | THN974-8 | Speed Nut |
| | THT972 | Screw |
| | TJB525100 | 75ohm/300ohm Unit |
| | TJB725401 | Antenna Terminal |
| | TJC6319 | Fuse Holder(L) |
| | TJC6320 | Fuse Holder(S) |
| | TJS27970 | Earphone Socket |
| | TJS29780-1PS | Power Socket |
| | TJS35161 | CRT Socket |
| | TKG69609 | Front Cover |
| | TKK159359 | Channel Indicator |
| | TKK60241 | Handle |
| | TKP1653382 | Alminum Panel |
| | TKX64901-1 | Bottom Cabinet |
| | TKZ69968 | SP Mount Metal(R) |
| | TKZ69968-1 | SP Mount Metal(L) |
| | TLC2036 | Convergence Yoke |
| | TMK14932 | Rubber Sheet |
| | TMK15568 | C Board Barrier |
| | TMK27236 | Heat Sink Barrier |
| | TMM14909 | Mica Sheet/IC801 |
| | TMM15547 | CRT Spacer |
| | TMM16489 | Nylatch |
| | TMM17205-1 | HV Cable Spacer |
| | TMM17445 | Canoe Clip |
| | TMM17538 | DY Wedge |

| Ref. No. | Part No. | Description | Ref. No. | Part No. | Description |
|---|---|---|---|---|---|
| | TMM27410 | U-Board Spacer | | | |
| | TMM76415-1 | Anode Lead Clamp | | | |
| | TMW6309-1 | Tuning Bracket | | | |
| | TMW6310-1 | Mounting Bracket | | | |
| | TNP16934ZA | Circuit Boad-N2 | | | |
| | TNP42138ZA | Circuit Board-L | | | |
| | TNP42139ZA | Circuit Board-S | | | |
| | TNP52598ZA | Circuit Board-B | | | |
| | TNP52967ZA | Circuit Board-C | | | |
| | TNP55080ZA | Circuit Board-G | | | |
| | TNP62276AA | Circuit Board-Ni | | | |
| | TNP62437AB | Circuit Board-U | | | |
| | TNP65858AB | Circuit Board-A | | | |
| | TNP66007ZA | Circuit Board-V | | | |
| | TNP66229ZA | Circuit Board-E | | | |
| | TNV56471F2 | VHF/UHF Tuner | | | |
| | TPC182020 | Packing Case | | | |
| | TPD155012 | Cushion(R) | | | |
| | TPD155013 | Cushion(L) | | | |
| | TPE24004-1 | Set Cover | | | |
| | TQB621113 | Fan Bag | | | |
| | TSA338-1 | UHF Antenna | | | |
| | TSA8108-11Y | VHF Antenna | | | |
| | TSN63113 | Purity Correction | | | |
| | TSX1174 | Power Supply Cord | | | |
| | TSX1304-2 | Car Battery Cord | | | |
| | TUX3921-7 | TR Collector Term | | | |
| | TXFKE01713 | Escutcheon | | | |
| | TXFKU01713 | Back Cabinet | | | |
| | TXFKX01713 | Side Cabinet(R) | | | |
| | TXFKX02713 | Side Cabinet(L) | | | |
| | TXFKX03713 | Top Cabinet | | | |
| | XANT125 | Neon Lamp/N001 | | | |
| | XANT322 | Neon Lamp/N351 | | | |
| | XBA1C05NU100 | Fuse 125V-5A/F802 | | | |
| | XBA1F30NU100 | Fuse 125V-3A/F801 | | | |
| | XBA1F50NU100 | Fuse 125V-5A/F851 | | | |
| | XEH3B1A1 | Earphone | | | |
| | XTC4+15BFC | Screw | | | |
| | XWC3 | Lock Washer | | | |
| | XWC3B | Lock Washer | | | |
| | XWG5H16 | Mounting Washer | | | |
| | XYN4+C8 | Mounting Screw | | | |



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